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—Photo by K.S. Sankhala





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Honorary Secretary.

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## Destination Doom

Rajaji Sanctuary in the Shiwalik Forest Division of Uttar Pradesh stands condemned to doom, through avoidable human action if the proposal before the Government of Uttar Pradesh is accepted and implemented for the permanent settlement of 'Gujars'—(a tribe of cattle breeders and milk vendors) who have been migrating for centuries from the foothills of Himalayas in Uttar Pradesh to Jammu & Kashmir—to Alpine pastures in high Himalayas in summer and down to the foothills in winters. At present they are only winter visitors to the foothill.

Rajaji Sanctuary, spreading from Jamuna to Ganga and named after Shri Rajgopalachari, the first and only Indian Governor General of India and one of our wise national leaders, was the happy hunting ground of Mogul Emperors and later the game reserve of the British for their yearly Viceregal shoots.

Since independence, Gujars have tended to become a menace to wildlife. Their cattle compete with wildlife for food, water and shelter. Gujars often invite poachers and are sometimes instrumental in the destruction of tigers and panthers by helping the nefarious fur trade which is responsible for shooting, poisoning and trapping.

Karnatak compensates for village cattle killed by tigers, Maldhari villages are being removed from Gir forests, tribal villages are being removed to areas outside Kanha-Kisli in Madhya Pradesh and similar action is being taken in other states also.

The clock seems to have been reversed in Uttar Pradesh where sanctuaries and wildlife reserves are being chosen as sites for permanent settlement of 'Gujars'.

There is also a proposal to set apart a thousand acres of sanctuary land and lease it out to a private individual to establish a deer farm and to commercially exploit the land and the ungulates.

Both the proposals, if accepted, will not only harm the fauna and the flora of the area but will be detrimental to the nearby villages, which have grazing rights in the area. Even the 'Gujars' would not willingly accept the withdrawal from the lush alpine pastures during summer and the local villagers in the foothills would not like the 'Gujar' cattle to compete with their livestock for food and water during the lean summer months.

We plead, press and hope that the Government of Uttar Pradesh will reject both proposals and thus save wildlife from certain doom and prevent the Ganga—Jamuna Shiwaliks from following the fate of Hoshiarpur Shiwaliks where no trees grow, no birds sing and one sees devastating erosion around.

# Game Ranching—A Productive Use of Marginal Land in India

SHANKAR RANGANATHAN

Game ranching or game cropping is the breeding of game animals for meat, hide, sport or transfer to sanctuaries and zoos. The activity is similar in many ways to cattle ranching, sheep rearing, or poultry farming. It is dissimilar mainly in that it is not practised as a mono-culture and also obviously because human knowledge in the field is very recent while animal husbandry relating to domesticated animals is one of the oldest sciences.

Domesticated animals like cattle, sheep and goats fitted well into human activity when human beings were nomadic, when the world's population was small and when there were vast areas which permitted migration to new pastures—in the manner of many birds, and some animals. But when the world's population grew with the advent of agriculture and when societies became static, the growing number of domesticated animals, restricted to a limited area rapidly destroyed vegetation beyond its regenerative capacity. Many parts of the populated world consequently witnessed the deterioration of good land through its misuse and overuse into poor, unproductive land. Flourishing civilisations in Mesopotamia, Greece and elsewhere have become extinct or been reduced to insignificance as a result of such denudation. A similar process is taking place in India where over the last thirty years the forest area has been greatly reduced.

Most tropical forests grow on rather poor soil—soil which without vegetative cover is prone to rapid erosion and consequent deterioration<sup>1</sup>. Where such land has been denuded of forests and cultivated, the crops have progressively become poorer. Land thus misused by man and his animals is what may be called marginal land or waste land. It is on such land whose productive capacity is minimal that game ranching can be undertaken in India. The enclosed table refers to barren and uncultivable land in the State of Gujarat. It amounts to over 20% of the total land used in that state and in area is about 4,300,000 hectares. Totally in the States of the Indian Union there must be many hundreds of thousands of square kilometres of such marginal or waste land. This land must be urgently benefitted to re-cover it with vegetation. Alongside with such measures, carefully controlled game ranching could provide for its optimum productive use and it would also generate rural employment.

It has been pointed out that wild ungulates are no more or less destructive to vegetation than cattle and in fact if numbers are uncontrolled wild ungulates can completely denude



forests even more thoroughly than cattle because of the fuller use they make of the vegetation between the grazers and the browsers<sup>2</sup>.

In India what makes game ranching practicable and attractive is that there is no religious sentiment preventing the cropping of game animals whereas this sentiment prevents the breeding of cattle for beef; hampers in brief, good animal husbandry being practised. It is the uncontrolled grazing of cattle, many of them unproductive bags of bones which, along with the denudation of forests for fuel hastens the spread of the desert in India. This denudation with its far reaching effects on erosion and ground water storage can only bring about a drastic reduction of food crops leading to serious, endemic famine conditions in the sub-continent.

Bearing in mind the great importance of population control to maintain, for sustained use, the quality of the habitat or range, it is possible to have a much higher biomass of ungulates that make fuller use of the vegetation than if only cattle or sheep were reared in the same area. A natural example is the Serengeti National Park in Tanzania where there are 2 million animals in 20,000 sq. miles, an average of 1 animal per 6 acres.

A mixture of animals with differing requirements of food is most suitable for optimum use of the land for maximising biomass per acre, because they would not be competing for the same plant species.

James Teer<sup>3</sup> says "As suggested by some wildlife scientists and geographers, fitting the animal to the vegetation might be a better approach than trying to fit the vegetation to the animal, especially on ranges that have been changed or degraded by man."

The difference in dietary habits in herbivores depends on their size and whether they are non-ruminants like horses and zebras. The relative maintenance requirement of a smaller animal is higher than for a larger animal because of its higher metabolic rate (due to a higher surface/weight ratio). It obtains this by feeding on plants higher in protein content. In their diet, small animals optimise on quality, large animals, particularly non-ruminants, on quantity<sup>4</sup>.

Marthe Kiley<sup>5</sup> writes with reference to extensive grazing system: "Mixed species grazing of agricultural animals can increase production on an extensive scale as well. It has been shown that the addition of cattle to traditional sheep hill pastures increased production from 26 lbs/acre to 54 lbs/acre..... It therefore seems logical to extend such thinking to include for example, red deer, goats, and ponies as well as sheep and cattle". She also says "Another reason for mixed species is that faecal contamination of grass by one species make the contamination area unacceptable to the same species but will not prevent another species from feeding there."

In the State of Texas alone (admittedly a very large state) in the USA the meat production from just the mule deer and the white tailed deer amounted in '72 to 22 million lbs/years<sup>6</sup>. This is more than the total meat production in many large developing countries.

How much meat can be obtained per acre of marginal land from game ranching? Deane and Feely<sup>7</sup> say that at the 2700 acre Ubizane Game Ranch in Zululand, S. Africa, 14 species including rhino, giraffe, zebra increased from 42 in 1966 to nearly 3600 in 1971. Biomass kg/km<sup>2</sup> increased from approximately 10,000 kg to 120,000 kg. Total dressed carcasses (game only) from 0 in 1967 to 96000 lbs in 1971. Yield/acre from 0 in '67 to 34.3 lbs.

That game animals with a modicum of care breed rapidly has been proved even in some of our zoos. At the Nehru Zoological Park in Hyderabad 20 chital in 5 years increased to more than 150. Several chital were transferred to the Pakhal Wildlife Sanctuary (Warrangal Dt. Andhra Pradesh) as well as to other zoos<sup>8</sup>.

14. In the Gir Sanctuary from 1970 to '74 when better protection was provided the population of the wildboar increased from 109 to 1822 and of sambar from 278 to 651<sup>9</sup>.

At Velavadar vidi in Gujarat which is about 65 km from Bhavnagar and 21 km. from Bervala, an area of approximately 890 hectares have been constituted into a Blackbuck sanctuary in 1969/70 under the Gujarat Wild Animals and Wild Birds Protection Act 1933. The number of blackbuck have increased from 300 to 400 animals in '69-70 to over 3000 animals. As the existing area is much too small to accommodate such a large number of animals the Forest Department is considering to extend the limits of the game sanctuary by acquiring the surrounding areas<sup>10</sup>.

According to Romulus Whitaker there are several areas in Tamilnadu and Andhra Pradesh where such activity could be considered and there is no doubt that the same would apply to most other States in India.

It has been suggested by Humayun Abdulali that animals other than ungulates and several birds could also be reared in such areas some of which would provide sport with bird shooting allowed in certain areas. Sport fishing is an activity which can be another attraction in such nature resources as well as camping and wildlife photography. There appears to be scope to develop several such ranches or reserves in every state.

This and the following two paragraphs are quoted from Ian McT. Cowan's letter to me. "Most wild species have a different mix of fat and protein than do domestic cattle. The protein yield from a wild game carcass is usually considerably greater in terms of



percentage than it is from cattle or sheep. Frequently also there is a greater proportion of the carcass represented in the hind quarters which is the better quality meat, so that there are quality issues as well as quantity issues".

"As a basis for rough calculation it requires about two and one-half pounds of vegetation on a dry-weight basis per hundred pounds of animal per day to maintain an animal like a deer or antelope. In order to calculate the yield, you have to know what the productive capacity of the range is in terms of the vegetation attractive to the species you are going to put on it. You then have to work out the biological potential of the species to produce harvestable individuals".

"In the forested areas of western North America, we have to have between five-hundred and eight-hundred pounds of deer in the woods to produce a hundred pounds that is harvestable. But this rule of thumb need not be applicable to Indian species—about which almost nothing is known that would help us calculate the various components that you, as a businessman would have to have in order to come out with a figure that you could depend on as a basis for your investment estimates "

Harvesting presents several problems. To produce quality meat the animals should be killed as humanely and quickly as possible and with minimum disturbance to the other animals as otherwise behavioural changes might affect not only their flight distance which would make harvesting uneconomical but could also affect breeding success. Various other factors like sex and age composition of the kill, whether a species is polygamous or monogamous, the age at which males and females become sexually mature also need to be considered<sup>11</sup>.

Hygiene for both meat and skin processing is vital. On the Rosslyn Game Ranch most meat is quickly processed into biltong (dried meat). Biltong has several advantages over fresh meat, being more economically transported and not requiring refrigeration<sup>12</sup>.

Animals which can be considered for game ranching in India are nilgai, chital, sambhar, hog-deer, pig, blackbuck, for intensive ranching on relatively small areas. For larger areas where the emphasis would be on sport shooting, in addition to the ungulates listed, their predators like tiger, panther, wild dogs etc. could also exist and be included in the cropping pattern.

24. Of the ungulates listed, from the point of meat production the nilgai may be the most suitable animal since it weighs upto 500 to 600 lbs and appears similar to the African eland in its disposition to form large herds and may be amenable to a degree of domestication as the eland is. However, as Humayun Abdulali says, what is true of the eland may not apply to nilgai since a detailed study of the nilgai has not been done. An interesting comment also provided by him is that the Moghul Emperors by firman changed its

name from Nilghor (Blue horse) to Nilgai (Blue Cow) to protect it from the sporting Hindus! The name may still prevent the nilgai being hunted in places where the rural people are predominantly Hindu. There is no doubt however that even in areas like Gujarat where the local people do not eat the flesh of the nilgai this animal is now shot. If there are such objections the meat can go elsewhere.

There are two types of game ranches which can be considered. One would be a fairly small unit of 3000 to 5000 acres which would be purely commercial and run along the lines of the Ubizane Game Ranch. Game animals here would be intensively reared for meat, hide, or transfer. The yield per acre would be highest on such a ranch. The other kind would be a much larger area of 50 to 100 square miles which would be managed as a commercial shooting block cum game ranch where conditions would be almost entirely natural, including predators. Controlled shooting of both the ungulates as well as their predators will be combined with additional cropping for the market. The total return in this case may be more from the fees charged to the sportsmen who visit this preserve than from merely meat for the market. The Rosslyn Game ranch in Rhodesia is operated in this manner<sup>18</sup>.

An essential ingredient for success is the involvement of the rural people in such projects through employment and a fair share of the benefits such as a share of the meat etc. There is no other way to prevent poaching than by ensuring that the rural people by being benefitted will want to help in the watch and ward. The main justification of the activity is rural development. It would provide employment and get rural participation and thus awareness of the importance of conservation to rural well being.

If this activity is taken up it can in course of time fit in as an extension to national parks and a common technical management cadre could be created to be in charge of national parks, game ranches and zoological gardens. Good management of all these would provide a powerful boost to tourism, both domestic as well as foreign. The activity would create jobs for many intelligent people in wildlife management and it would develop country-wide interest in natural history. The tourist department would be honestly able to publicise India's wildlife and natural beauty because both would then be capable of being saved for future enjoyment and profit.

### Conclusion

There is general agreement that game ranching has great potential for development in India. Obviously there are many gaps in our knowledge like the productive capacity of a range (rate of growth of various species of plants and rate of usage of various plants by different animals), the biological potential of the species to produce harvestable individuals; the problems involved in harvesting of game and many other problems. However,



according to Ray Dasmann of the International Union for Conservation of Nature, "Discussion can be endless. The best thing in my opinion is to go ahead and start a project and during the five years required before harvesting can be taken up, many of the present 'gaps' can be filled from field experience and a literature survey of work done elsewhere".

My suggestion therefore is that the Regional Committees of WWF India approach the Forest Departments, sportsmen and wildlife enthusiasts in their regions to initiate a discussion on the prospects of getting such a project started. The ideas that come out of these regional discussions may help get atleast one project in game ranching started soon somewhere in India.

### Synopsis

Game ranching the husbandry or management of wild ungulates on marginal (waste or uncultivable) land in India would provide a productive use of a wasted natural asset that needs urgent beneficiation in the interest of soil-conservation and ground water storage. Game ranching would appreciably increase protein supply for domestic consumption and export. It will help restock our depleted wildlife sanctuaries.

This activity while contributing to environmental education would provide gainful employment in rural areas. The rural people, by participating in such projects will understand the importance to their welfare of practising conservation.

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**Land-use classification—(Area in 100 hectares) 1967-68**

| District                   | Total reported area<br>for land utilisations<br>purposes | Forests      | Barren and unculti-<br>vable land | Land put to non-<br>agriculture uses | Cultivable waste | Permanent pastures<br>and other grazing<br>lands | Land under miscella-<br>neous tree crops and<br>groves not included<br>in area sown | Current fallows | Other fallow land | Net area sown | Area sown more<br>than once | Total cropped area,<br>i.e. gross cropped<br>area |
|----------------------------|----------------------------------------------------------|--------------|-----------------------------------|--------------------------------------|------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|-------------------|---------------|-----------------------------|---------------------------------------------------|
|                            | 1                                                        | 2            | 3                                 | 4                                    | 5                | 6                                                | 7                                                                                   | 8               | 9                 | 10            | 11                          | 12                                                |
| 1. Jamnagar                | 10412                                                    | 757          | 1821                              | 421                                  | 287              | 748                                              | 23                                                                                  | 212             | 174               | 5969          | 363                         | 6332                                              |
| 2. Rajkot                  | 11062                                                    | 351          | 1379                              | 577                                  | 169              | 996                                              | —                                                                                   | 152             | 57                | 7381          | 295                         | 7616                                              |
| 3. Surendranagar           | 10172                                                    | 134          | 1689                              | 243                                  | 320              | 472                                              | —                                                                                   | 337             | 234               | 6743          | 71                          | 6814                                              |
| 4. Bhavnagar               | 9260                                                     | 266          | 764                               | 303                                  | 362              | 929                                              | —                                                                                   | 270             | 121               | 6245          | 156                         | 6383                                              |
| 5. Amrali                  | 6419                                                     | 293          | 32                                | 213                                  | 122              | 477                                              | —                                                                                   | 188             | 71                | 5023          | 113                         | 5136                                              |
| 6. Junagadh                | 10621                                                    | 1810         | 699                               | 432                                  | 100              | 1355                                             | 14                                                                                  | 265             | 97                | 5849          | 571                         | 6420                                              |
| 7. Kutch                   | 44202                                                    | 953          | 31930                             | 228                                  | 1637             | 861                                              | 38                                                                                  | 583             | 1483              | 6489          | 158                         | 6645                                              |
| 8. Banaskantha             | 12040                                                    | 1544         | 160                               | 267                                  | 283              | 734                                              | 48                                                                                  | 627             | 68                | 8309          | 1002                        | 9311                                              |
| 9. Sabarkantha             | 7084                                                     | 1321         | 254                               | 119                                  | 205              | 316                                              | —                                                                                   | 271             | 103               | 4495          | 488                         | 4983                                              |
| 10. Mehsana                | 9460                                                     | 68           | 262                               | 773                                  | 486              | 749                                              | 35                                                                                  | 61              | 49                | 6977          | 711                         | 7688                                              |
| 11. Gandhinagar            | 676                                                      | —            | 50                                | 6                                    | 20               | 64                                               | —                                                                                   | 2               | 11                | 523           | 46                          | 569                                               |
| 12. Ahmedabad              | 8515                                                     | 23           | 1565                              | 61                                   | 251              | 153                                              | —                                                                                   | 145             | 181               | 6136          | 214                         | 6350                                              |
| 13. Kaira                  | 6917                                                     | 270          | 227                               | 749                                  | 71               | 271                                              | —                                                                                   | 47              | 52                | 5230          | 587                         | 5817                                              |
| 14. Panchmahals            | 8937                                                     | 2334         | 454                               | 301                                  | 299              | 444                                              | —                                                                                   | 299             | 81                | 4725          | 721                         | 5446                                              |
| 15. Baroda                 | 7803                                                     | 641          | 403                               | 389                                  | 150              | 696                                              | 22                                                                                  | 43              | 31                | 5428          | 163                         | 5591                                              |
| 16. Broach                 | 7731                                                     | 1578         | 573                               | 435                                  | 107              | 269                                              | 1                                                                                   | 137             | 40                | 4591          | 32                          | 4623                                              |
| 17. Surat                  | 7377                                                     | 1683         | 489                               | 137                                  | 40               | 374                                              | 39                                                                                  | 86              | 63                | 4466          | 252                         | 4718                                              |
| 18. Bulsar                 | 5251                                                     | 1279         | 488                               | 80                                   | 145              | 194                                              | 2                                                                                   | 39              | 70                | 2954          | 263                         | 3217                                              |
| 19. Dang                   | 1785                                                     | 964          | 169                               | 39                                   | 26               | 4                                                | —                                                                                   | 86              | 13                | 484           | 1                           | 485                                               |
| <b>Total Gujarat State</b> | <b>185724</b>                                            | <b>16269</b> | <b>43408</b>                      | <b>5773</b>                          | <b>5080</b>      | <b>10106</b>                                     | <b>222</b>                                                                          | <b>3850</b>     | <b>2999</b>       | <b>98017</b>  | <b>6207</b>                 | <b>104144</b>                                     |

By Courtesy: Gujarat State Forest Department.



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  - 12 & 13. P.A. Johnstone—*Wildlife Husbandry on a Rhodesian Game Ranch*—Paper 52, Symposium on "The Behaviour of Ungulates and its relation to Management".
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# Forest Resources: Multiple Use Management and Conservation

By

PRAKASH N. MISHRA

## Introduction

Multiple use management of forest resources is neither new nor unusual. It is as old as the practice of forestry itself, and the very term 'multiple use management' implies forestry in the case of forests. There is basic agreement on the fact that forestry is not merely management for timber production alone, or for water, or for wildlife, or for recreation alone. Rather, forestry is the management of forest areas to meet all reasonable desires and needs of the community in the best possible manner. These reasonable desires are in fact a listing of the benefits that can be expected from forests and they include—

1. Wood, that remarkable, renewable raw material that is used for many purposes in homes and industries.
2. Other material products, including drugs, oils, resins, honey, decorative materials, etcetera.
3. Protection for water catchments.
4. Rough grazing for domestic stock.
5. Habitat for native animals.
6. Preservation of sites of particular scientific significance.
7. Educational material to broaden knowledge and increase understanding of the environment.
8. Outdoor recreation in its many forms.
9. Beautification of the landscape.

It is doubtful whether such a thing as single use management—the opposite of multiple use management—is at all possible for forests. Regardless of the primary use to which a forested area may be put, it is going to serve other purposes as well. For example, all forested areas provide habitat for some wildlife, and more often they are very significant and valuable areas of habitat. However, the distinction has to be made between obtaining ancillary benefits involuntarily, and deliberately providing a variety of benefits through the management practices adopted. True multiple use always has this element of deliberation attached to it of knowingly aiming to provide a variety of valid benefits.



In brief, multiple use involves giving the community forest areas that will positively contribute to the development of a pleasant and productive environment. This environment has to be of a type that the people as a whole would wish to have near them to meet a wide range of both their material and non-material needs.

### **Compatibility and Planning**

Quite obviously not all possible benefits can be obtained from a single acre of forested land. Whereas some forest uses are fully compatible with each other, others may be largely or completely incompatible. Thus, while timber production and the more intensive forms of recreational use are incompatible with strict ecosystem preservation, the provision of wildlife habitat may be fully compatible with water catchment protection. Due to these different levels of compatibility between uses, the application of multiple use management almost invariably involves the establishment of various zones within the forest, with different priorities or combinations of use within each zone. The zoning, which is familiar to foresters as the breakup of forest areas into the working circles of the traditional forest working plan, necessarily involves adequate resource inventory, so that sites with special features as requirements can be recognized, and due cognizance given to their needs in the management of the area as a whole.

This should be a regularly repeated business, allowing for new information and techniques and for changing patterns and forecasts of demand. With relatively few exceptions, forest land management has to retain the flexibility to change and adapt with the constant evolution of society. The planning associated with forest management should ideally be carried out in the context of the whole region, rather than solely on the basis of the forest itself. Certainly, forest managers must always be aware of the effects and impact of some of their activities well beyond the forest boundary.

By definition, the quintessential feature of a forest is its trees. Even the fastest growing trees tend to be long lived and slow developing organisms in comparison with most human affairs. This imposes particular difficulties on forest management, since many of the actions started today will not come to a fruition for decades and often for a century or more. The planning for management has to be carried out with long range forecasts which will almost inevitably prove wrong because of social, political and technological developments in the intervening years. This does not mean that forecasting should not be attempted. It is in fact essential, but it serves to emphasize the need for the regular revision and updating of management plans.

### **Forecasting of Demand**

Perhaps everywhere, the three uses that dominate the multiple use management of forests, and for which the forecasting of demand trends is essential, are wood, water and recreation. It is estimated that the world consumption of log timber will more than double within the next quarter century, if not sooner. This forecast demand estimate will most probably change in the next five years. However, the fact remains that the world

annual wood consumption will inevitably increase considerably over present levels and that forest lands will be subjected to a much more intensive usage.

Rainfall, over the world, varies widely and in several areas the overall availability of water is low in relation to the large populations in those areas. There are major water problems because of the varying distribution of available good quality water in both time and space. A substantial portion of the water comes from catchment areas that are forested and represent a large portion of the world forest resources. It is expected that the water usage will probably increase two to three fold by the end of this century. So, the future development of several areas in the world will depend a great deal on the availability of water. This implies that increasing demands for the management of forested catchments to yield good quality water must be expected.

If estimates of future wood and water demand are hard to obtain and are clouded by uncertainties, when we come to recreational use of forested land estimates even of current levels are difficult to obtain. Figures can be obtained for specific areas, but no broad picture of recreational usage is available. Nevertheless it is apparent that there is a relatively high level of current use in many places and that this use is increasing at a rate substantially above the rate of population growth. Estimates show a six to eight fold increase over the next twenty five years. On the other hand, recreational use of forests is to a large extent associated with the levels of affluence, mobility and leisure in the community. In the era of the 'Energy Crisis', projected rates of increase in some of these may not be maintained. All indications are that world's forests will have to meet substantially higher levels of use for wood and water production and for recreation in the decades ahead, while at the same time meeting the needs for the other uses listed previously.

### **A Question of Economics**

The basic objective of multiple use is to ensure that the resource is employed in that combination of uses which yields the greatest net benefit. In the case of forests, determination of the net benefit has to include consideration of costs and benefits to society as a whole. Although, in economic terms, the problem is a matter for cost-benefit analysis, in practice there are great difficulties involved in quantifying many of the values involved in terms appropriate for economic analysis. It seems that some alternatives to monetary value are needed as bases for gauging the benefits of varied resource outputs.

Nevertheless, in the light of present knowledge, the rational basis for determining the most appropriate form of multiple use management lies in the field of economics, through cost-benefit analysis, with its four major steps of resource inventory, definition of alternatives, forecasts of demand, and finally evaluation and choice. Where the techniques



are not available for the evaluation of net social benefits, then the problem can usually be reframed in terms of 'opportunity cost'. For example, consider an area which has two mutually exclusive potential uses, wood production and retention as wilderness. There is no measure of the psychic benefits of wilderness use, real as they undoubtedly are. If wilderness use is adopted, the 'opportunity cost' to the society will be the (measurable) foregone social benefit of wood production. The decision maker must therefore weigh subjectively whether the social benefits from retaining a wilderness would exceed its 'opportunity cost', thus defined.

Multiple use forest management is in fact well established in several places covering various geographic situations and various combinations of uses. All of these concern areas where the continued production of timber or other forest products is one of the benefits being sought, and was a major reason for those particular areas having been set aside. Only in a few cases have the processes that have led to the introduction of deliberate multiple use management borne much direct relation to the economic approach outlined above. However, in all cases the management objectives would have been based, albeit less formally, on the four above mentioned stages of periodic inventory, examination of alternatives, forecast of demand, and finally choice of priorities, with current community attitudes and social pressures playing no small part in determining the final balance of uses and priorities.

### **Factors in Multiple Use Management**

The problems and challenges of multiple use of forest resources are greatest on lands where the production of wood is one of the objects management. What actions are necessary if such areas are to be managed with a view to conserve, as far as possible, the quality of the environment? In answering this question, several points must be borne in mind—

1. Increasing volumes of wood will be needed in the years ahead and self reliance needs to be developed to satisfy this need.
2. Every logging operation involves some disturbance to the environment.
3. Environmental disturbances are neither new nor particularly unusual in the continuing existence of a forest, which may be subject to fire, disease, and storm, in the natural course of events.
4. Where the disturbances are man made, endeavors to minimize adverse effects, particularly long ones, are necessary.

5. The effects of an environmental disturbance are not necessarily adverse and for many purposes they may be highly beneficial.

In light of these considerations, several suggestions can be made as to what action should be taken to provide benefits from the forest other than wood production. Some of these are—

- I. Logging, roading and other management operations should never be carried out in such a manner as to cause significant or permanent damage to water catchment values. Appropriate protection of catchments should always be given a high priority in the management of forested areas.
- II. Forest services should have trained staff to advise them on wildlife matters, and should ensure that their operations never lead to the regional elimination of any species of wildlife.
- III. Controlled grazing can often be valuable as a forest use and as a forest management tool. However, such use should be excluded from scientific reference areas, and the exclusive use of the forest by graziers should be carefully avoided, particularly in sites with high recreational value.
- IV. In all operations, adequate protection should be assured for sites of particular scientific or cultural significance; in addition, efforts should be made to ensure the preservation of undisturbed examples of each of the various plant communities and their associated wildlife.
- V. At little cost, it is possible to produce well presented information about the forest to instruct, amuse and stir the imagination of both casual visitors and organized groups. Such interpretative programmes can be of great value not only to the visitors but, by helping to create a more informed and understanding public, to the forest manager.
- VI. In general, forests should be available for recreational use, though the forest manager should reserve the right to close all or part of a forest to the public for management or safety reasons.
- VII. Flexible attitudes to forest recreation are needed. What is inappropriate in a near urban setting, may be perfectly acceptable in the more remote forests.
- VIII. In planning forest operations, recreational use should always be considered—ranging from the effects of logging or other treatments on recreation to the provision of specific recreational facilities.
- IX. Close consideration should be given to the aesthetic impact of any developments or operations planned for forest areas, so that they can be carried out with the least long term disturbance to the visual environment.



### **Multiple Use in Specific Forest Management Situations**

The operations associated with the management of forests for wood production vary greatly from place to place in their form and impact, but there are a few major operations which are widely employed and where scientific suggestions can be advanced with a view to seeing that the capacity of the forest to provide other forest benefits is adequately maintained.

### **Plantations of Pines and Other Species**

The establishment of plantations of conifers has had a great environmental impact and in some cases has produced a new and different element in the landscape—though one that is not in itself ugly or unattractive to most people. These plantations are usually capable of greater rates of wood production than other types of forest and, for economic reasons, they are often established in fairly extensive and concentrated blocks. Where it is necessary to create these man made forests on land currently supporting native forest, the conversion should be carried out in such a manner as to protect as far as possible the quality of the environment. That is:

1. Retain any sites of particular scientific or local significance.
2. Retain under natural conditions an adequate sampling of the native vegetation, representing the full range of environmental conditions present in the block. (A suggested area would be about 10% of the total involved.)
3. Also retain natural vegetation in strips along all perennial watercourses and major depressions, and in any sites not needed for planting.
4. Retain strips of native vegetation for landscaping purposes, for example along some of the roads.
5. Design the whole programme to enhance, as far as practicable, the appearance of the landscape (by consciously maintaining chosen patterns of native forest/plantation/grassland, for instance, and by plantings of other suitable trees).
6. Adopt the procedure of planting annually on a number of relatively small, scattered blocks rather than a single large block.
7. Carry out all operations—clearing, roading, fertilizing, etcetra—so as to minimize any risks of stream pollution.

Guidelines such as these are already in vogue in some places. Similar guidelines can be introduced for the establishment of man made forests using native species.

### **Clear Cutting**

Clear cutting systems of silviculture involving the removal of the existing timber crop over a reasonably large area in a single operation, and its replacement by a new crop

of regeneration, of essentially uniform age, have a long history in the practice of forestry. They are simple to apply and they yield high volumes of timber per unit area of forest. They are usually associated with high growth rates. For many commercially important forest communities, they represent an adaption of the system by which the stand naturally regenerates (taking the place of, for instance, the fires which ordinarily permit the regeneration of mountain ash). And they can have a marked impact on the visual environment. Clear cutting has been successfully practised in many places for many decades, but has recently attracted some criticism.

The criticism has various bases, significant among them are: the very large scale of some of the operations; the apparent lack of attention paid in some instances to the aesthetics of the operation; and often the emotional issue of the sale of a natural resource outside the region. Again, guidelines to reduce to impact of these operations can be suggested.

- A. Limit the size of individual logging coupes.
- B. Scatter operations to provide a mosaic of coupes of various ages and stages of development.
- C. Ensure the adequate protection of soil and catchment values (including avoiding clear cutting on slopes susceptible to excessive erosion, retaining unlogged strips along water courses, and breaking and draining all logging tracks after logging is complete).
- D. Where clear cutting is essential, retain some unlogged or selectively logged stands for as long as possible and in some cases permanently to demonstrate the dynamics of overmature, evenaged communities. (For example, the replacement of stands of mountain ash or flooded gum by other species in the absence of fire and regeneration.)
- E. Where clear cutting is not essential to regenerate the stand, retain belts of selectively managed forest in localities of visual significance and to provide environmental diversity.

### **Selective Logging**

Selective logging, with the periodic harvesting of only some of the trees in the stand, also has a long history, initially as uncontrolled 'sawmiller selection' and later as silvicultural systems of various forms requiring a rather high level of skill in their application. It has generally proved successful in the drier eucalyptus forests, in cypress pine forests, and in rain forests. Selective and clear cutting silvicultural systems, very often, are not alternatives: they are suited to different forest conditions. However, it is usually easier to satisfy multiple use objectives under selective systems, and where there is indeed a choice between the two systems selective logging will usually make the greater contribution towards conserving the quality of the environment.



### **Stand Improvement Operations**

Treatments to improve the productivity of native forests—particularly by the elimination of trees of commercially useless form or species—are widely practised, and are indeed often essential in bringing previously unmanaged forest to the state where it can maintain a high level, of sustained timber production. However, attention should be paid to ensuring the retention of some trees that provide particular types of benefits, other than timber, in the local scene—the large old trees with numerous nesting holes, for example.

### **Rainforest Management**

Rainforest, in its various forms, is quite common in several places. It provides many benefits, not least in the supply of some of the finest timbers. Rainforest stands in timber producing areas are sometimes managed by conversion from one species to another. While there are sound ecological and silvicultural bases for such practices, there seem to be strong grounds for attempting to retain any of the more extensive and better preserved stands as rainforest, with careful and relatively conservative management and with the direction of the timber produced to the appropriate speciality and high value end uses.

### **Roading**

Roading is an essential feature of forest management. Roads can be significant causes of stream pollution, and adequate attention should always be paid for minimizing this risk. Close consideration should also be given to aesthetic effects of road construction, both on the landscape as a whole when viewed from a distance, and on the actual roadline itself. Many forest roads will ultimately receive more use by recreationists than for other purposes, and this should be recognized in their design, construction and maintenance.

### **Communication**

Multiple use brings about a much closer awareness and interest by the public generally in the management of forest areas. This provides both the opportunity and the necessity for genuine two way communication between the forest manager and those who are using and enjoying the forests. The manager should be active and use all appropriate means to explain and demonstrate what he is doing, why he is doing it, develop means for the users to express their views and ideas about the forest and its management, with some likelihood that sound views, reasonably presented, will be heeded and considered. Not only should the public be encouraged to identify itself with the management of the forest, but similarly the forest manager should seek to understand and appreciate better the role of the public, as users of the forest who seek thereby to enrich the quality of their lives.

Multiple use involves certain added costs. It also involves compromise. It will never fully satisfy the desires of every user—be it for timber, virginal forest beauty, untouched wildlife habitat, or whatever. Yet for the community as a whole, management aiming to provide a range of benefits should represent a major advance not only towards

supplying man's material needs but also towards conserving the quality of the environment. The compromises required—in understanding the other fellow's reasonable views and desires, and in sincerely attempting to satisfy all or part of these—are perhaps basic to any pattern of truly civilized living and behaviour.

Multiple use can be an extremely efficient and flexible tool for meeting a wide range of valid community requirements, and should be widely adopted, particularly in those areas where the commercial production of timber is one of the primary aims of management. Its application is widespread and at times in a very efficient manner. However, as in most fields of human endeavour, there is always scope for improvements.

### **The End of Hunting Safaris ?**

Safari hunting is now forbidden in CHAD, northern Ethiopia, Northern Mozambique, Somalia, Tanzania, Uganda, Zaire and all West African countries except Cameroun and Gabon. As a result professional hunters are gloomily contemplating their own extinction. In India Shikar Companies still exist.

### **Poaching in Assam**

A man hired by a poaching gang slashed the trunk of an antipoaching squad elephant in Manas Sanctuary. The truing authorities let him off with a small fine. Assam has not yet accepted the Wild Life Protection Act 1972.

### **Privilege Withdrawn**

Abuse of diplomatic privilege by members of foreign embassy staffs in India has lead the Prime Minister to withdraw the immunity of diplomats who infringe protective wildlife legislation.



# Sport—Vandalism—Conservation

By

R.S. DHARMAKUMARSINHJI

After having spent most of my life enjoying sport with the gun it would be paradoxical to say that the sport of small game shooting as practised by most is one of the cruelest in the world. Let me now explain why. Unless one is a Dr. Karni Singh of Bikaner, most of us who shoot small game, specially the beginners, do not bring down game bird or animal cleanly and a large number of birds specially ducks go wounded and are not retrieved. Even a perforation in the alimentary canal or in the vitals of a bird when it escapes wounded and is not found must die a painful and lingering death. That is why, we were told that we must strive our best to find and bring to hand any wounded bird and relieve it of its pain at once. Therefore, we often spent hours searching for a wounded bird before giving up. In a beat when guns are marching quickly in a line, a wounded bird if not picked up soon is left as the guns continue marching on. In quail shooting, we always kept flags so as to mark the place where a wounded bird had fallen and could not be picked up at once; and after the shoot, a search by shikaris was made and the result reported; even then all birds, specially winged ones were not traced. In duck shoots particularly when many guns shoot at high or distant birds and are unable to shoot accurately, pepper birds with shot; I regret to say many do go wounded without even the shooter being aware of the fact. Most ducks when winged fall in water, dive well, and are difficult to retrieve under adverse conditions such as deep water and aquatic vegetation and are therefore lost. I know of cases where men have been drowned attempting to retrieve fallen duck. Myriads of ducks in the past must have been wounded in the grand old duck shoots of yore. The more we visualize this aspect the more ghastly it looks. However, it is not the intention of any hunter to wound his game but since the possibility is so great, one cannot omit the fact that there is tremendous amount of wounding in small game shooting specially duck and those game birds which have immediate access to escape into thick cover. To minimise losing a wounded bird, the gun dog is the best assistant, but I hardly see in India it being used. Next to the dog is a good sighted shikari, a profession now on its way out. However, certain game birds and large ones too, are more easily bagged although I have seen some going wounded, largely due to the firing of the wrong size of shot and out of range. Small birds like snipe and quail are those which are more easily found when dropped. Sandgrouse, though hard to hit fall to earth and have less cover to escape when wounded. There is in fact a decline in number and type of game which go wounded, but when using

the correct shot (which in India is not easily available) the chances of bringing off a clean shot at the proper range are much more than otherwise.

Although duck shooting has been the most varied and interesting shooting owing to the many species seen at one place, it is doubtless one of the cruelest sports owing to the large number of birds wounded and lost. The bag limit means less gun practice, which means more wounding, and unless one has done ample shooting of clay-pigeon, the chances of wounding are much greater. Of course, even the best shots in the world will mistime and wound a bird, when using the wrong size shot. Therefore, the whole method and idea of small game shooting in India should be revised and rules framed to minimise wounding of game in addition to the selection of game which can be easily collected after being hit.

Even in rifle shooting, I know of animals being wounded and lost, i.e., Elephant, Gaur, Leopard etc., despite every effort to secure them. By and large, however, in big hunting the trophy is secured. There is now a code of using the more effective rifle and bullet for the purpose.

Small game shooting is now done from vehicles or over water, the former illegal the latter only for water birds and sandgrouse. Hence I would be closing my eyes to facts if I believed that most sportsmen hunt on foot in India. And yet the hunting rules stick to principles which cannot be checked or enforced and are therefore redundant. Most people now hunt for meat. This hunting for the pot has no principles. Females, young and any other animals are killed at any time. A number of hunters have opined that young juvenile birds are better eating than old ones. This might be true but bagging such birds is neither sport nor conservation. Moreover, the excuse to hunt for food is in some circles justified and people sympathise with tribals or nomadics who hunt wildlife galore with the excuse that their main occupation and survival depends upon hunting. In some areas tribals do have hunting rights. But surely the law should apply to everyone. Even diplomatic privileges are being curtailed for wildlife preservation. Widespread killing of all game except vermin should be totally stopped. If shooting for meat is allowed from vehicles it must be mentioned by the hunter while returning his licence and it must be restricted to roadside only, under rules of using proper size shot and reasonable range. What is required is that the game list be revised so as to eliminate the cruel part of it or at least minimise it to the least. I would like sportsmen to ponder over this aspect and express their views. It is no use sticking to old ways all the time for all time and yet if some sport is to continue it has to be reassessed in the light of a new outlook and humaneness specially in a Country where non-violent philosophy has been known the world over. A total ban on small game shooting does not appear practical in a country armed with guns of all kinds. Nevertheless, if game is to survive and sport continue, a proper code for hunting should be devised without endangering any species. That is conservation.



The old list of game birds has to be reappraised and method of hunting also, in view of the present trend and conditions. Rigid rules which cannot be enforced are outdated. Is the pleasure of seeing a bird being killed in the air fully justifiable? Is such killing sport? I know it is good to see a high bird crumble after an accurate shot; it is the art of shooting; but is the killing justified? Perhaps so because it is a clean shot, but how many times can a clean shot be made and by how many? Is the destruction of life for pleasure commensurate with the amount of wounding which is likely to occur? Even trigger-happy hunters enjoy mass slaughter yet it is condemned by sportsmen. Mass destruction of wildlife for commercial gain is no sport and has caused considerable harm to many species. Even slaughter of game to eliminate disease in Africa has failed.

In India, the old list of game birds is large whereas today many non-game species are classed as game in the new Wild Life (Protection) Act, 1972. Such is the jumble. No doubt some of the non-game birds could be placed on the shooting list and I have consulted Dr. Salim Ali, our well-known Ornithologist, that birds such as Green Parakeets are most destructive to crops, and they could be placed on the game list as has already the Rosy Pastor in some States. It is amazing how much animal life is edible when we study some of the food habits of some of the hunting tribes who eat meat from crocodile to cat. The sporting idea of giving the game a chance to escape has rescrinded and people are bent towards obtaining meat easily and that too the tasteful type. The question is whether to legitimatize hunting from wheel driven vehicles or not and what? Night shooting except on kill must be prohibited.

All this quota in commercial wildlife trade is an eyewash as in Whale exploitation, and indiscriminately it is a form of vandalism. The drain on reptiles, is something which is now being realized after the last Session of the Indian Board for Wild Life and yet frogs legs are being exported '*en masse*' without realizing what useful purpose frogs serve to control insect pests. The whole concept of exploiting wildlife for commercial gain has to be reassessed. Except for replenishing Zoo exhibits and bartering, or for Avicultural needs and specimens for Museums, trapping or killing of wildlife as a trade must be completely stopped, as is now in Australia.

If hill game shooting is allowed, as it should, and when big game have to be culled for conservation measures, shooting game while stalking as a sport is fully justified. Whether to impose Royalty on game shot is a separate matter. Here the idea of shooting from vehicles is sacrilege, and no shooting for the pot allowed. In no case must the species be threatened with extinction. However, capture of live animals for rehabilitation or breeding may be done but such animals are not usually old, or useful as trophies.

Of animals which require to be reduced as causing damage to crops, whether sportsmen should be given permission or not requires careful consideration. If crop-

protection guns are to be banned, then Government should itself organize the killing. In fact, controlling harmful wildlife is a professional and expensive operation affording little pleasure. Proper management of game species is the best way to conserve it. It may involve culling or strict protection as local conditions demand.

If photography can be encouraged and wildlife awards be given from the educational to the aesthetic and scientific point of views, it would mean a better interest in wildlife preservation. Cameras and equipment if not made in India should be freely allowed. Seeing wildlife in pictures is more enjoyable and educative than seeing stuffed animals displayed under a roof except in natural history museums. Although hunting in the past has served a conservation knowledge it cannot be compared with modern ecological studies of wildlife as done by people like George Schaller whose studies of the Gorilla, Swamp Deer and the Tiger, and African Lion are of much value. Now with co-operation for protecting indigenous species under an International convention the chances of indiscriminate and overexploitation of wildlife is reduced.

Notwithstanding, conservation of wildlife in India, should encompass the control of harmful wildlife, allow legitimate sport without endangering species, minimising wounding of game at the same time protecting nature so as to maintain a certain balance and provide enjoyment, aesthetic recreation and preservation of wildlife for the people for all time. Nevertheless, ecological changes will take place even in the best managed areas as a form of evolution under changing environmental influences. It should be remembered that all kinds of recreation or studies are not conducive to wildlife preservation. Where wildlife and its habitat has priority, man must be careful while enjoying its presence. The public needs to be educated accordingly. If this is assured, man, animal and plant will co-exist happily.

To summarise the entire theme I would like to say that small game hunting should be reappraised for preventing wounding and suffering of game. The ethics of sport need a more practical view. Vandalism should be stopped. Game farms to supply meat to the poor tribes be encouraged. State control over harmful animals. Wholesale commerce in wildlife to be stopped. Conservation with the understanding that natural adaptations have the greatest survival value.

I see the following changes:

- A. (1) Small Game Shooting permitted; passing of shooting tests after which licences to be given.
- (2) Proper size shot to be used for the appropriate game, and list of such game made.
- (3) Special powers under the Act for those with gun dogs and holding valid licences.



- (4) No shooting of Duck, Geese, Swans, Doves or Shore Birds except Snipe, Woodcock, Curlew, Whimbrel Ruff and Crane (migratory).
  - (5) No Bag Limit.
  - (6) Special permit for shooting game from wheeled vehicles on roads or cart tracks.
  - (7) A blanket ban of shooting at Close Time and only those game notified to be shot, with the correct size shot. Close time suggested. 1st March to 1st October.
  - (8) Revision of game list according to local availability. State Wildlife Advisory Board level.
  - (9) Game licence must be with hunter at time of hunting.
  - (10) Game shot in District be publicly announced species wise and State report purported.
  - (11) Small game licenece holders be publicly announced.
- B. (1) Big game shooting allowed of unwanted or decrepit animals in Hill areas and in Forest Blocks, as prescribed by State.
- (2) Special licenece for trapping animals for rehabilitation and for Zoos and collecting permits for Museums.
- C. (1) No commercialisation of wildlife except of vermin whose meat can be sold in market as directed by government.
- (2) Control of harmful pests by government and withdrawal of all crop-protection guns.
- (3) Provision of game farms for poor tribals and communities thriving on wildlife. Government subsidies to create farms by such people to be encouraged with technical guidance. Cessation of illegal exploitation of wildlife.
- D. (1) Encouragement of wildlife photography with numerous awards prizes for best photographs and films. Free availability of cameras and equipment. Production of films or equipment to be encouraged.

### APPENDIX—A

#### *Recommended Sizes of Shot:*

Crane and birds of the size of Peafowl. SSSSG. AAA. AA. BBB. BB. 1 & 2.  
For Jungle Fowl etc., 3.4.

For Sandgrouse and Partridges. 5 & 4.

For Pheasant, Hare and similar game. 6.5. or 4.

For Snipe, Quail etc. 7 or 8.

(Reference The Shooting Man's Bedside Book compiled by "B.B.")

P.S. Guidelines for the beginner and the sportsmen be printed.

## Pugmark Tracer

By

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*Director, Project Tiger, India,*

The tiger, most magnificent of the greater cats, has always fascinated hunters in India, specially during the days of the British Raj and the princely order. Tiger hunting was the principal sport of big-game hunters during the 19th and the early 20th century. The sport was considered 'perfect' when the most elusive tiger was produced for hunting almost at command. This was possible because the shikaries had perfected the technique of tracking tigers and had sufficient knowledge of their habits. They had devised their own methods. But the technique was based on empirical knowledge and experience along-with guess-work, which could neither be spelt nor transmitted in any form for the benefit of others. This could hardly be called a scientific method.

When I started my study of the ecology of the tiger, I found these methods of measuring footprints with straw sticks, split bamboo, or sometimes simply the fingers and guessing the size of the tigers, to be utterly unscientific. These measurements gave no information about the size or shape of the animal's footprint nor did it give any idea of the stride or any other feature of the animal's behaviour or association.

I decided to devise my own method. My first attempt to record footprints was by making a tiger walk on a cleared and prepared ground at Delhi Zoo. The impressions left on the ground were recorded on a glass plate. The impression was then transferred on to a white paper by tracing against light.

This involved cumbersome repetitions and increased the chances of multiplying errors. Next I tried tracing with transparent paper mounted on a transparent plastic plate. The method was satisfactory but the paper would always slip while tracing. This created difficulties in handling. Also the slipping of paper on the plastic sheet charged the plate. This electrically charged plate attracted dust particles. The diffusion due to dust made it difficult to get a second impression.

To cover these defects I devised the present tracing-board. It is based on a combination of a film camera spool system and a cavalry board used for stock mapping forest areas. (Fig. No. 1 and No. 2.) The instrument became handy and I did my entire field work of tracing pugmarks (footprints) of tigers and other animals with its help (Fig. 7).



## Description

- (i) An aluminium frame 'A' 210 mm by 265 mm.
- (ii) A glass plate 200.5 mm by 200 mm  $\times$  3 mm enough to cover even the biggest footprint of a tiger or even two prints partially overlapped (Fig. 4).
- (iii) Three spools—200 mm long (one spare for quick work) 'c'.
- (iv) Thin cellophane transparent paper 200 mm wide 2 to 3 metres long.
- (v) Art or felt pencils of indelible ink.
- (iv) Simple cover with a handle for convenient handling and transport.

All the components are indigenous. A scale diagram of the apparatus is provided in Fig. 2.

The instrument consists of a glass plate mounted on an aluminium frame the two sides of which contain spool holding cassettes. The cassettes keep the glass plate high enough (3 mm) from the ground to provide enough space not to touch the impression and sufficient light for tracing the impression left on the ground. To provide more light on shaded impressions, a provision of four detachable screws have been made. These screws can be adjusted to make the plate parallel to impression in case it is on a sloping ground. The cassettes bottoms are covered and protect the cellophane paper from coming in contact with the ground.

The spools are interchangeable. They bear a slit for facilitating loading cellophane paper on the spools. Each take is a 2 metre film which can record 30 footprints of full grown tigers. Empty spools can be replaced by spare loaded spools. It is rarely that one needs to record more than 60 impressions in a day. Even if this is needed another extra spool can solve the problem. The impressions are traced with a felt or art pencil or signature pen which are commonly available with stationers in the market.

Screws help to transport the film, both forward and backward. They have self-locking device to stop and lock the film at any fixed position. This facilitates tracing of impressions. The screws have release springs. The spools are easily removed from the position for replacement by pulling down.

A spool is loaded with cellophane film 3 metre long and 200 mm wide by locking one end of the film in the spool slit and rolling the spool. The loaded spool is placed in the left hand cassette. Open end of the film is then taken over the plate and fixed in the open slit of the other spool and rolled with the help of screw. Care is taken that the film rolls fully stretched and close to the plate. This is ensured by having the film from the lower side of the first spool and moving the second spool in a clockwise direction.

Fig. 1

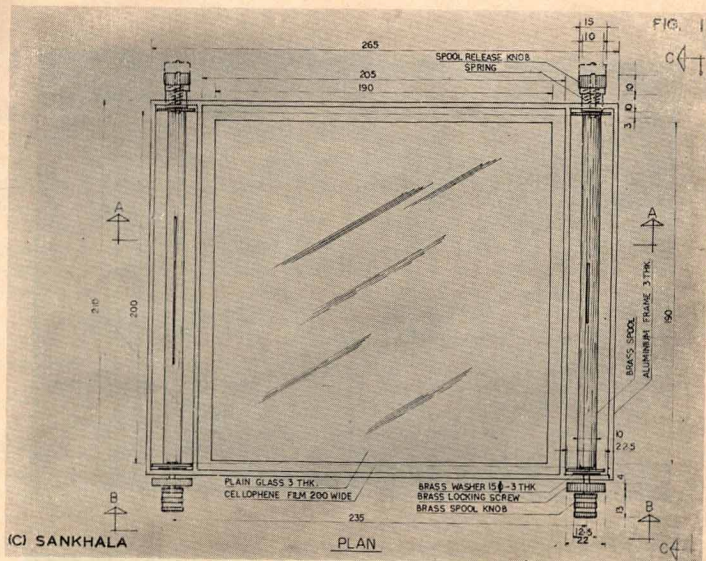
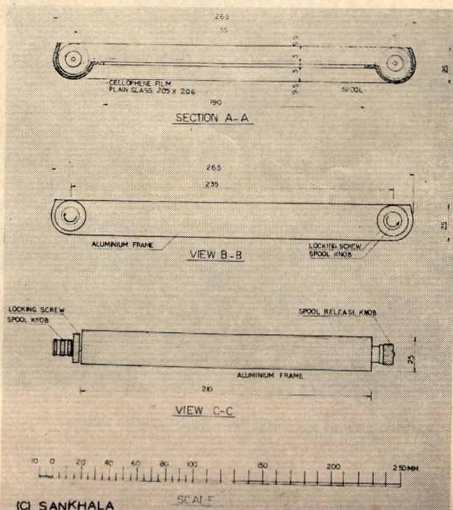


Fig. 2







Fast walk of a tiger.



A normal walk of a tiger showing two limbs of the same side above ground.

(See Page 32)

## Operation

The board is now ready for operation. The board is placed on ground over an impression. The transparent cellophane paper and the glass plate allow enough light to make the impression clearly visible. The impression is traced with the help of an art or felt pencil. Additional information like direction, place, date is recorded on the sides. This becomes a permanent record. The film is rolled-in with the help of transport screwing and a clear portion of the film comes over the glass plate for next record. Since the film is continuous, it helps to record clearly the overlapping footprints by advancing the film. It also helps to record two or even four footprints as they appear on the ground. This makes available the valuable data of spacing between the footprints and strides. The board to trace any other valuable information like intermingled pugmarks of cubs, leopards, hyaena or prey animals.

## Precautions

- (i) Care is taken that the operator looks vertically down to minimise errors.
- (ii) The impression should be traced in one operation. This helps to avoid any error due to refraction or error due to change of angle.
- (iii) In case of ink pencil the impression should be allowed to dry before being rolled on.
- (iv) The operator should have sufficient practice of tracing in order to have a steady hand.

The data sheets are classified and recorded as original field notes

Tracings are made from these sheets for other references and studies. The original records are maintained properly classified for all references.

The board has been fully field tested during my field studies of the ecology of the Indian tiger as a Jawaharlal Nehru Fellow. All my records are based on this system.

## Merits

- (i) The tracing made in the field is a permanent and final record.
- (ii) This eliminates errors which creep in while retracing from plastercasts or glass plate etc.
- (iii) The continuous cellophane film system eliminates cumbersome system of taking out papers or cellophane pieces which create problems of safe wrinkleless storage in the field.
- (iv) It helps to study locomotory patterns of animals by tracing footprints as they appear on ground clearly depicting their pattern. This helps to understand the



FIG. 3

TIGER  
LOCOMOTORY PATTERN

RIGHT HIND



SCALE IN CMS.

3

RIGHT FRONT

(C) SANKHALA

locomotion of the tiger. This is clear from the figures 3, 4, 5 and the photograph (A) of a walking tiger.

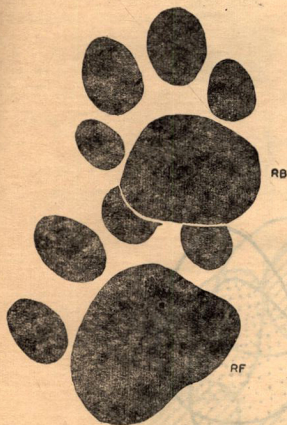
(v) Self-locking system helps to operate the instrument without any additional assistance.

TIGER  
LOCOMOTORY PATTERN

FIG. 5



FIG. 4



SCALE IN CMS

(C) SANKHALA



(C) SANKHALA

(vi) Provision for backward movement helps to bring in old records for consultation and comparison on the spot. The transparent nature of the document makes it easy to compare by placing on the impressions to be compared.

(vii) Interchangeable spools help to load a new unused cellophane film and keeps the Instrument ready for any number of operations. Each spool records 30 impressions. One extra spool is enough for a long day's work.

(viii) The spools with film can be easily loaded in the field.

(ix) The whole process is quick, easy, clean, in-expensive, accurate and makes a permanent record.



# PUG MARKS OF TIGER (JIM ♂)

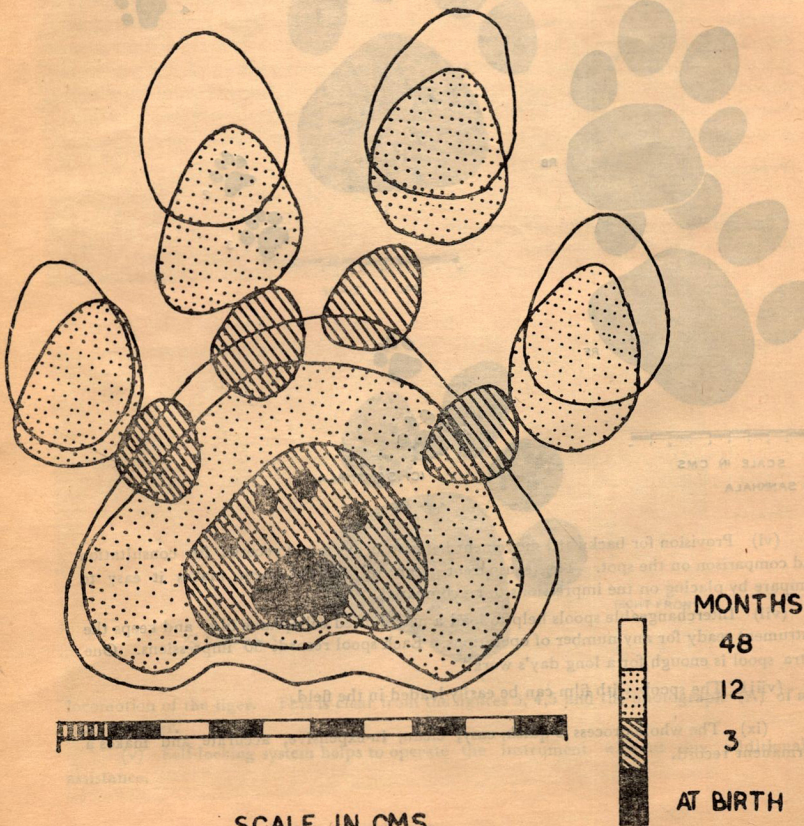
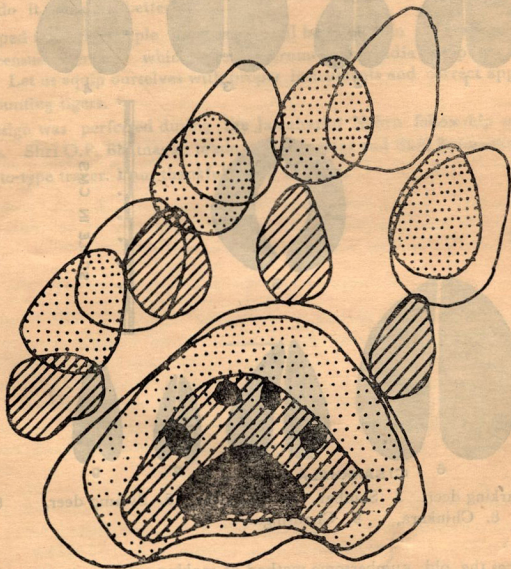
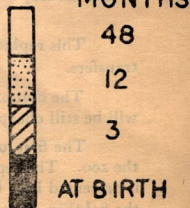


Fig. 6

## PUG MARKS OF TIGER (VIMLA ♀)



SCALE IN CMS.



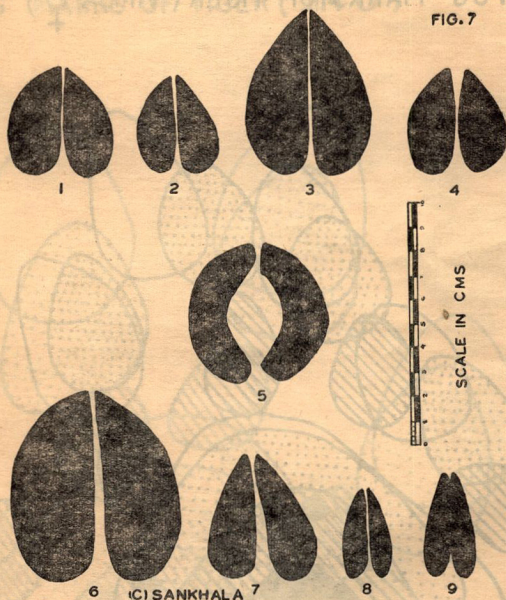
(C) SANKHALA

Fig. 6A



## FOOT PRINTS

FIG. 7



1. Chital, 2. Barking deer, 3. Sambar, 4. Hog deer, 5. Swamp deer, 6. Nilgai,  
7. Blackbuck, 8. Chinkara, 9. Chausinga.

This replaces the old cumbersome method of making plaster casts and tracing transfers.

The cost of the instrument is hardly Rs. 59/-. If manufactured on a large scale it will be still cheaper.

The first use of the instrument was made in 1967 in tracing pugmarks of tigers in the zoo. The repeated observation since then recording the growth of pugmarks of tigers is presented here to enable those interested to make their own stencils for aging tigers in the field (Fig. 6 & 6 A). The tracings are of actual sizes. The instrument was also presented

to the first International Cat Symposium held in Los Angeles, USA in March, 1971. The contemporary workers on the mountain lions and lions in South Africa showed keen interest and it was considered as a major breakthrough in the field of wildlife study. One of them said, 'I can now keep a crateful of plaster casts in my pocket'. The instrument is not the last word. It still needs sophistication and improvement. I hope someone will do it and do it better.

It is hoped that the simple instrument will be useful in field studies of the tiger specially for census operation which the Government of India proposes to undertake during 1976. Let us equip ourselves with proper instruments and correct approach to the problem of counting tigers.

The design was perfected during the Jawaharlal Nehru fellowship so generously granted to me. Shri O.P. Bhatnagar made the drawings and Shri Bramanand of Jaipur made the proto-type tracer. I am thankful to all of them.

Editor.



# Distribution of the Indian Lion Over Centuries

By

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In the thirteenth century A.D. the great traveller Marco Polo visited the royal Chinese court at Peking and was surprised to find lions at its entrance. These were imported probably from some other country since lion is never recorded to have been found in China.

The immense popularity of lion the world over has also been due to the fact that some time or the other in the past many millenia, it has been a resident of most countries of at least three continents—Europe, Asia and Africa. It existed in all those countries that were first to rise to civilization, such as, Greece, Mesopotamia, Egypt, Persia, and India. Though extinct in all these countries except India, it continues to be well preserved in their legends handed down from generation to generation.

The origin, spread and abrupt decline of lions make a fascinating story.

Its extinction from Asia, barring a tiny pocket that is the Gir forests in India, towards the end of the nineteenth century was a tragedy wrought about solely by man. Its lack of craft and guile made it an easy victim of the unprincipled hunters who joined in the wanton orgy of killing lions just to improve their shooting records rather than from the noble considerations of sport. Hosts after hosts of lions vanished for ever. Whereas it took so many thousand years to spread and colonise in far scattered countries, it did not take even half as many centuries for almost total extinction of the species in Asia.

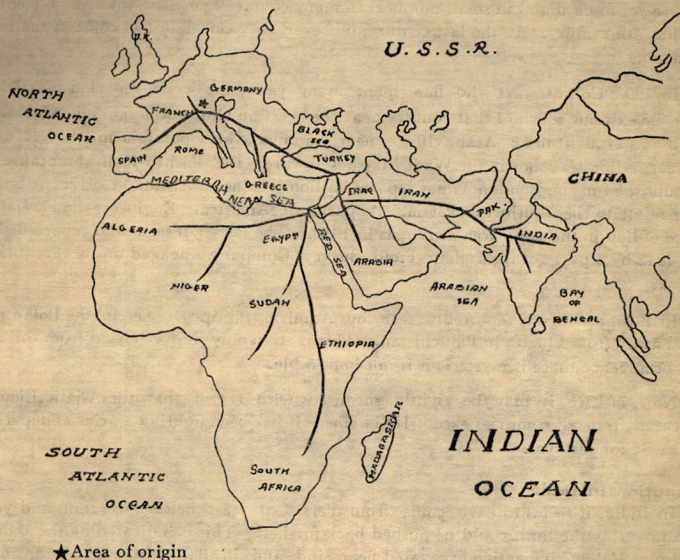
## Origin

All available records on the subject strongly indicate that lions originated somewhere in Europe. Further evidence also suggests a broad pattern in which they fanned out over other two continents of Asia and Africa. A general idea of the origin and migratory trends of lions can be obtained from Map 1.

The wide distribution of lions is evident from the historic records available in form of fossils, inscriptions, paintings, great religious books, journals and memoirs of kings and also their chroniclers, great travellers and naturalists. All these evidences lead to the theory that lion probably originated in the central Europe from where it spread farther.

The extinct cave lion, which surpassed all modern specimens in size, was found almost all over Europe. Fossil remains unearthed in England, Germany and France indicate their existence over the entire central Europe in the prehistoric times.

## ORIGIN AND DISTRIBUTION OF LIONS



In historic times, it was found in the Balkans and the valley of Danube running across South Germany, Austria, Hungary, Yugoslavia and Rumania. From Europe it spread into North-western Asia to ultimately diverge in two directions: westwards over Africa through Egypt; an eastwards to India through Persia.

The lions entered India through the north-western passes like Bolan. The northernmost limit of lions in Asia was in Caucasia, lying between the Black Sea and the Caspian Sea. According to some, its range probably included China, though this seems very doubtful.

### Spread in Asia

In Asia, it spread in Mesopotamia, Arabia, Persia and the Indian sub-continent. In these countries lions were found in good numbers upto the end of the eighteenth century A.D. From the nineteenth century onwards their population in Asia started depleting



rapidly, mainly due to indiscriminate destruction by man. Though greatly destroyed, they were yet to be found in small numbers in many countries of Asia towards the end of the eighteenth century. In the last century, however, they certainly had come to the verge of extinction.

In 1903, Col. Stewart who had spent many years in Persia, reported presence of lions in the extreme south of that country near the Persian Gulf and adjoining Arabia. A lion cub was brought to an Arab village near Sanniyat, Mesopotamia in 1916. In the same year, a lion was shot in the Wadi Marshes towards the Pusht-i-Koh Mountains. A letter published in the London Times reported a lion seen near Ahwaz in 1917. All these records relate to the southwest Persia. A party of American Engineers had reported presence of lion in the same area as late as in 1930. The last lion seen and reported there was in 1942 by a party of the Indian Field Survey Company engaged on survey works in that area.

In 1935, a lion was reportedly seen by Admiral Philip Dumas in the Bolan pass, 25 miles away from Quetta in Baluchistan. This is the only lion reported from this area and its occurrence there is mysterious if not impossible.

Now, in 1975 it may be rightly surmised with regret that the Asiatic Lion has disappeared from all countries except India where it has been fighting a grim and perhaps losing battle for survival.

### **Distribution in India**

In India, it seems to have come from Persia at least before six thousand years, though probably the limit could be pushed back further. This is indicated by the remains of the Indus Valley civilization excavated near Sind and in Baluchistan, as also from the great ancient Hindu books of Vedas. That India could not have been its country of origin is suggested by the fact that it never spread in the south India beyond the Narmada river. If it were indigenous to India, it should have spread over the entire Peninsula.

In the times of Buddha, six centuries before Christ it roamed over the entire Indo-Gangetic plain extending from Sind in the west to Bengal in the east. The Himalayan foothills formed their northern limit, while the Narmada seemed to be its extreme limit in the south. There are no noticeable references to lion in the ancient south Indian Tamil literature except at times when the noble animal provided a simile for some heroic king.

The above happy state of abundance prevailed at least upto the beginning of the nineteenth century. Mughal Emperor Jehangir, a great naturalist, who kept detailed notes on wild game, hunted a lion near Malwa in 1617. He also recorded a lion hunt by his father Akbar. It was he who permitted Sir Thomas Roe, the first English ambassador to India, to kill a lion in his camp near Mandu in Central India.

Lions disappeared from the Western India around 1840. They were seen in Kot Diji in Sind, about 20 miles east of Mohen-jo-dero in 1842, and in Haryana in 1834. In the eastern regions it was reported to be alive at least upto 1814 when it was seen near Palamau in Bihar.

Outside Kathiawar peninsula, it seems to have lingered longest in the Central India and Rajputna. In 1822, lions were found in ample numbers in Uttar Pradesh near Saharanpur, in northern Rohilkhand and around Moradabad and Rampur. Col. Stewart reported a lion hunt south of Allahabad in 1853. Another lion was shot at the 80th mile from Allahabad on the Jabalpur railway in 1866. Col. Fenton reporting in 1909, quoted an old well known army officer of the Central India Horse who informed him that during the time he was with the regiment presumably before 1910, no less than 26 lions were shot by the officers posted in the Central India. The last Asiatic lion to be shot in the Central India was near Goona in 1873. It was lastly seen in the above region in 1884.

After 1884, nothing was heard about lions except that one was shot near Kotah in 1922, another near Jhansi in 1926, and a third one in the same year in Panna State. These three lions shot in 1922 and 1926 were probably of African race derived from the stock which had been released about 1920, as an experiment, in the Shivpuri forests by the Maharaja Scindia of Gwalior for reintroducing lions in the central India. More about this interesting experiment later.

Coming nearer the present abode of lions in the Gir forests, we find evidence of their occurrence in Gujarat outside Kathiawar peninsula right upto 1881. In 1830's they were found in good numbers on the banks of the Sabarmati River and around Mount Abu. Blanford has recorded presence of lions within and around Gujarat during the last century at various places, namely, Palanpur (1814), Ahmedabad (1830), Baroda (1832), Ahmedabad (1836), Anadara (on Rajasthan border of Gujarat 1872), Deesa (1878), Palanpur (1880) and Abu (1881).

Around Deesa they were plentiful and scores of them were shot by the British cavalry officers stationed there. Hunting lions from horseback had been their favourite sport. The last lion outside Saurashtra was shot by Col. Heyland of the Old 1st Bombay Cavalry on the Deesa race-course in 1878.

Map 2 shows distribution of lions in India during the nineteenth century.

In Kathiawar, lions were found besides the Gir forests, as far as Dhrangadhra, the Sihor hills, the wild tracts around Chotila, Jasdan and few other places in the north, and in the Barda and the Alech hills in the south. The late Jam Vibhaji of Nawanagar had shot lions in the Barda hills as a young man, whereas the late Thakore Jaswantsinghji of Bhavnagar had shot one near Sihor in 1850's. It was also found staying in the Girnar



## DISTRIBUTION OF LIONS IN INDIA, NINETEENTH CENTURY A.D.



hills, 20 miles away from the Gir forests, upto 1879. The late Maharaja Ranjitsinghji of Nawanagar, the immortal cricketer who had spent a good period of his boyhood in Junagadh State, had heard lions in the areas much distant from the Girnar forests.

The Barda Hills were deserted by lions towards the later part of the nineteenth century probably as a result of the guns fired by the British army pursuing the wagher outlaws hiding in the hills. In 1879, a party of three lions including a lion, a lioness and a cub was seen there. The Administration of Porbandar State wished to preserve them but before they could do so the animals were killed by the Rabaris and the Police of Nawanagar State stationed there.

A few decades back, the Barda hills were connected with the Gir forests by the Alech hills and a wild tract extending between Dhank and Chorwad on the seacoast; the Girnar hills were connected with the Gir forests by a semi-wooded rough country. The Mitiyala forests are only 14 miles away from the outermost boundary of the Gir forests and the intervening tract is rugged, hilly and sparsely populated. During the monsoon months the lions used to move away from the central Gir forests, as they do even today, in search of more favourable conditions to escape discomforts caused by mosquitoes, tall grasses and annual rank growth of weeds.

It can be safely assumed from the available records that by about 1880's the lions were extinct from all over India except the Gir forests which then covered about 800 square miles of forests containing mostly thorny scrubs.

After 1880 also, it is true, some lions were found in the areas away from the Gir forests notably in the Girnar hills of Junagadh State and the Mitiyala forests of Bhavnagar State. These lions were occasional migrants from the adjoining Gir forests and were not the true residents of these areas.

In Mitiyala, they started appearing from 1917 onwards. They were reported last from that area in 1955 at the time of the second lion census. 23 lions were shot in this reserve over a period of 26 years from 1920 to 1946. In the census of 1963, no lions were reported from there.

In the Girnar forests, they were frequently seen in very small numbers till the last one was reported in the 1963 census. Nine lions were captured from the Girnar forests over a period of fourteen years from 1944 to 1958. No lions were reported from this area after 1963 except in 1975 at the time of census. The intervening absence is mysterious.

With the spread of cultivation and clearing of wooded tracts, their monsoon wanderings in the farther areas have become impossible and ultimately they have to confine themselves to less than 500 square miles of the Gir forests. This area also is shrinking fast due to the opening of roads, heavy grazing by domestic cattle and deforestation.

### **Lions in Gir**

It is difficult to say when exactly lions entered Kathiawar peninsula in general and the Gir forests in particular. The earliest mention of the forests and wild life of this region is made in Mahabharata, the great sanskrit epic written perhaps before 1000 B.C.

The above epic records the great war that was fought between the two mighty clans of Kurus and Pandavas around 1500 B.C. on the battleground of Kurukshetra near present Delhi. Hitherto, many efforts were made chiefly by the British sponsored historians to dismiss this war as a legend and declare contents of the Mahabharata as legendary. However, very recent researches in the subject indicate that the war was a historic event. Dr. Radhakamal Mukerjee, a great authority on ancient Indian history and culture has put forth evidence that Krishna the famous author of Bhagavad Gita and the chief architect of Pandava's victory in the war, was not a mythical or legendary figure but was a great warrior and sage who existed around 1000 B.C. This great epic records a relative of Krishna being killed by a lion from the Raivataka hills another name for the Girnar hills. According to K.M. Munshi, who has done considerable research on Krishna and also written books on it, the Raivataka hills are, however, the same as the present Gir hills.

Even if the Raivatikas were synonymous with the Girnar hills, it would not make much difference to the inference that lions were found around 1500 B.C. in the Gir forests because the Girnar and the Gir hills are hardly twenty to twenty five miles apart. If the



lions were found in the former hills they were certain to be found in the latter ones also. Actually this was so upto the end of the last century.

After the Mahabharata, there is no mention of lions in any book of great antiquity. However, lion has been mentioned in many bardic songs composed in the praise of Princes and Kings. These songs have now become a part of the folklore of Kathiawar. These references could be linked upto the period around 900 to 1000 A.D. In the times of the Muslim rulers, that is from the fourteenth to eighteenth centuries, occasional references to lions have been made in their dispatches, chronicles or memoirs.

The bardic traditions of Kutch sing praise of a Kutch prince who saved the life of a Muslim king, Mahmud Begda, by slaying a lion that had charged upon the king. The event is claimed to have taken place near Gondal, a place only 30 miles from the Girnar hills. Mahmud reigned in the 15th century A.D. This event also indicates existence of lions in the Girnar and the Gir forests in an unbroken link from at least 1500 B.C. to recent times.

Whereas the above evidence only suggest occurrence of lions as a wild species, they give no idea whatsoever about their quantitative distribution. The earliest, though not accurate, record of the lion population in the Gir forests is by Colonel Watson who wrote that part of Kathiawar gazetteer which dealt with the State of Junagadh in whose territory these forests were mainly situated. He was a great *shikari* and had a great knowledge of these forests. In 1880, he considered that not more than a dozen lions were left in the Gir forests. They had, of course, been wiped out from the other parts of country.

Watson's estimate was no doubt a very conservative one but nevertheless it points out the grim fate lions had met with. Watson's figure was not an official estimate. That was made only many years later. In 1893, an official estimate of lions residing in the territory of Junagadh State, which included the Gir and the Girnar forests, showed a total of 31 lions.

A second official estimate was made in the year 1900 which showed the entire lion population to be consisting of 19 animals including 8 cubs. This estimate rather underestimated their actual numbers. It is noteworthy that in that very year Kathiawar was in the grips of an unprecedented great famine, like other parts of India. During this famine most wild life died due to scarcity of water and fodder. Domestic cattle also perished in great numbers. This famine may have badly affected the lion population also. It was precisely from this year that the Gir lions started systematically preying upon domestic cattle and entering villages disregarding their inherent tendency to keep away from man.

The 1900 estimate of 19 lions, however, inaccurate though it was, became unexpectedly instrumental in focussing attention of many high Government officials on the subject

of lions. Taking advantage of this estimate, a few wild life enthusiasts launched a campaign in the Bombay papers for the protection of the Gir lion. This campaign, whether it was deliberately so planned or not, coincided with the arrangements that were being made for a lion shoot by Lord Curzon, the then Viceroy of India. On being told about the dismal state of lion population, Curzon abandoned the project and wrote to the Nawab of Junagadh for taking adequate measures to ensure preservation of the vanishing species.

In spite of the official estimates giving very low figures for lion population it can be safely assumed that the figure was between sixty and seventy around the year 1904. This is the figure given by Major Carnegie, who was deputed to Junagadh State in 1903. He was keenly interested in lions and his estimate was not a guesswork like the previous estimates. He had undertaken a systematic study about the lion population during his two years' stay in Junagadh. For sometime he obtained all the records of lions seen or spotted anywhere in the Gir forests and outside. In a particular week alone he had a tally of 25 different lions. Much more information about lions could have been available had his life been not cut short tragically in 1905 by a charging lion while he was accompanying the shooting party of Lord Lamington.

It is to be noted that in all papers and publications on the Gir lion Carnegie's figures are never mentioned and reliance is placed entirely on unreliable official estimates thus lending to a false perspective of the facts of lion population. It seems, however, that the low figures were given wide publicity to restrain demands on the State of Junagadh for shooting lions. To that end, it did achieve some results.

The ruler of Junagadh State, Nawab Rasulkhanji took Lord Curzon's advice seriously and banned all shooting of lions in his territory. But unfortunately his appeal for preserving lions was not reciprocated by the neighbouring five States who continued shooting lions that usually strayed in their territories. The policy of preservation tended to increase lion population but it was attended by a serious trouble.

As stated earlier, during the great famine of the year 1900, the lions though reduced in number frequented villages and often mauled human beings. This trait was further strengthened after protection and the lions now became a serious menace to human lives. In 1901, in Nawab's own State 31 men were killed by lions and another 6 mauled; in 1904, 29 men were killed and 11 mauled. Though no figures of death by lions are available for the intervening years 1902 and 1903, they could not have been less than those killed during the above two years. Apathy of the neighbouring rulers and heavy toll of human lives by lions dampened the Nawab's enthusiasm for the lions and he reluctantly relaxed the policy of strict protection.

With the death of Nawab Rasulkhanji in 1904, British Administration took over the reigns of Junagadh State during the minority of the new ruler and practically no



attention was paid to lions, except for arranging lion shoots, for about a further decade.

In the year 1913, another bombshell about lion population was dropped in the form of a report submitted by Captain Wallinger, the Chief Forest Officer of the State, to the Administrator of State, Rendall. The report based on the two months' tour of the Gir forests in that year, stated that only 6 to 8 lions were left in the forests. He further asserted that this number could not be more than 20 in any event. Wallinger's estimate was fully endorsed by Brooke-Fox, the Chief Engineer of State, who was himself a keen *Shikari* and knew the forests intimately.

Wallinger's report caused a stir in the concerned circles and led Rendall to declare a total ban on shooting of lions in Junagadh State. Like Rasulkhanji who had earlier tried to impose, though unsuccessfully, a policy of protection of lions, Rendall also urged the adjoining states to observe the ban in their territories. The latter, however, hardly paid any heed to the wise counsel. Not only that, on many occasions they baited Junagadh lions to cross over the Nawab's territory and then promptly shot them. In several instances, on getting information, the forest staff of Junagadh foiled such attempts at baiting.

Detailed rules were framed by Rendall in 1913 to ensure effective protection of lions. Later, when the lion population showed satisfactory increase, shooting of lions was reintroduced but shooting was limited to a maximum of three lions in any year. These rules remained in force upto the year 1948, when the princely rule came to an end with the state becoming an integrated part of the independent India.

In passing, it must be mentioned that but for the unco-operative attitude of the neighbouring states the lion population would have been more stable. In spite of the pious hope as reflected in the administration report of Junagadh State for the year 1913-14 that "with the support of the (Crown) Agency, the endeavours of this State to preserve an interesting and unique species will continue to meet with generous and sympathetic response in the neighbouring territories" poaching outside the Gir forests continued unabated. In 1920, Sir Patrick Cadell, one time Administrator of Junagadh State, and a staunch protagonist of lion protection, estimated that 10 to 12 lions were poached annually in the neighbouring States. Again in 1935, he reported poaching of at least twenty two lions in the three seasons preceding 1935. All the same, it must be recorded to the credit of the British administrators of Junagadh, that their efforts alone salvaged 'the unique species' from total extinction despite the repeated poachings.

It would be interesting to know how the lions fared after the gloomy forecast of Wallinger in 1913. No census of lions was carried out till the year 1936. The only information about lion population during this long interval is obtainable from Cadell who estimated their strength at 50 in the year 1920, and at 75 to 80 in 1935. Curiously, it was

circulated in the London Times in or around that year, which was also further quoted in General Burton's book, that there were 200 lions in the Gir forests. This figure was obviously highly exaggerated and far removed from truth.

In 1936, a census was carried out over an area of 700 square miles that comprised the Gir forests with the help of 534 enumerators, consisting mainly of *shikaris* and beaters each of whom was keen to report an animal, alive or not. The result of this census showed a presence of 287 lions in Gir. The enumerators thought, they would get more *baksheesh* if more numbers were reported. This figure was in all probability much in excess of the real population.

Four more censuses were conducted between 1950 and 1970. In 1950 M.A. Wynter-Blyth, and M.S. Dharmakumarsinhji conducted second lion census and reported population of 219-227 lions. In 1955, a third lion census was carried out under the direction of Wynter-Blyth. This census showed the presence of 290 lions in the Gir forests and its surroundings. The fourth census held by the Forest Department in 1963 gave a figure of 285. The fifth census was carried out in 1968 by the Forest Department when 177 lions were reported to be living in the Gir forests. The sixth and the last 1975 census showed a total of 170 lions.

Apparently, the lion population in the Gir forests made great advance from 'about a dozen or so' in 1880 to more solid 170 in the year 1975. Statistically, the lions multiplied about fifteen times over a period of about ninety years. If the figures were only guides the present position of lions should have been considered extremely happy. However, despite steady and substantial rise in their numbers from the dreadful days of 1880s, the chances of their survival have not brightened proportionately.

As a matter of fact, the probability of survival of this unique species has sharply decreased over last twenty years. This appears paradoxical in face of the excellent, and probably better by any previous comparison, measures taken for their protection. This paradox is created because of the great ecological imbalances that have been brought about in the years following independence of India in the year 1947. These artificially created imbalances have greatly shrunk the natural habitat of lions, thus diminishing their chances of survival.

However, a redeeming factor is successful implementation of the Gir Lion Project since 1972, results of which are already encouraging. If the project succeeds, as it should, the lions have one more chance of survival.



# Handrearing of Crocodile (*Crocodilus palustris*) at Delhi Zoological Park

By  
A.K. MALHOTRA

In July 1973, three nos. of Crocodiles were procured as gift from Bilapur fisheries department. At the time of arrival at Delhi Zoological Park they were estimated to be about 20 days old. Their weights and measurements were taken and were kept in a glass aquarium measuring  $12 \times 30 \times 30$  cm. A layer of 10 cm. of sand was provided in the aquarium and 5 cm. water was maintained in the aquarium. A dry space for the Crocodiles was provided by making a  $15 \times 20$  cm. brick platform in a corner of the aquarium.

Initially live fish, measuring 3-4 cm. were released in the aquarium. The reptiles were found to take 2-4 fish per day per head. A fortnightly record of their measurements and weights was kept (Table I).

According to David Reuben (1970) the Crocodiles measured 28 cm. (11") in length at birth. The size differing only very slightly between individuals. He further states that during early growth period they increased 2.5 cm. in length per month and after the age of 12 months their growth rate increased to 4-5 cm. per month. Mahendra Prakash (1971) states that the young reptile soon after hatching measures 28-30 cm. with 90-100 gm. in weight. The young can bite, see and swim with ease.

At Delhi Zoological Park it was observed that the length of the Crocodiles increased at 2.55 cm. per month during the summer season. But as the cold season approached the reptiles were found to be passive and their appetite decreased resulting in loss of weight. However, with increase in temperature they became active and gained weight.

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Table—I

Weight in gm. and increase in length in cms. of young Crocodiles

| Age in days | 1st Young Crocodile |        | 2nd Young Crocodile |        | 3rd Young Crocodile |        |
|-------------|---------------------|--------|---------------------|--------|---------------------|--------|
|             | Length              | Wt.    | Length              | Wt.    | Length              | Wt.    |
| 20          | 29.15               | 65.00  | 32.15               | 90.00  | 30.40               | 70.00  |
| 35          | 30.70               | 74.75  | 33.40               | 101.75 | 31.30               | 85.00  |
| 50          | 22.80*              | 91.00  | 34.60               | 109.00 | 33.00               | 102.00 |
| 65          | 23.75               | 102.00 | 35.05               | 119.00 | 34.20               | 110.50 |
| 80          | 23.80               | 99.05  | 35.30               | 123.00 | 35.00               | 127.00 |
| 95          | 24.10               | 100.05 | 35.55               | 129.00 | 35.50               | 138.00 |
| 110         | 24.00               | 98.05  | 35.30               | 135.00 | 35.45               | 140.05 |
| 125         | 23.85               | 96.00  | 35.30               | 132.20 | 35.55               | 136.00 |
| 140         | DIED                |        | DIED                |        | 35.40               | 132.00 |
| 155         |                     |        |                     |        | 35.25               | 132.05 |
| 170         |                     |        |                     |        | 35.00               | 132.00 |
| 185         |                     |        |                     |        | 34.90               | 126.00 |
| 200         |                     |        |                     |        | 35.05               | 131.05 |
| 215         |                     |        |                     |        | 34.60               | 128.00 |

\*Tail was cut off accidentally.



## Book Reviews

**Tiger Haven** by Arjan Singh, published by Mac Millan was published in 1973. The author, a son of the late Kunwar Jasbir Singh, was brought up in the trans-Rapti area of Gonda District (U.P.) where the latter was for several years Special Manager of the Balrampur Taluka on behalf of the Court of Wards. After a spell in the Army during the war, Arjan Singh took up farming in the northern portion of Kheri District. Here he graduated, as many others have done in their time, from being a mere shikari to become that far more interesting and important species, the photographer and conservationist of wild life. His book contains detailed descriptions of the wild life of the area, all based on close personal observation. In particular, he has made a special study of the tiger, now not far from its apparent end. He has also kept a variety of animals/ reptiles as pets, including a young *terai* python, which, however, soon died. Pythons, for the benefit of those who wish to have one around the home, are, we are told, a very docile species in captivity, but at the same time are very delicate and need attention.

Most important of all, Arjan Singh is not a mere conservationist in theory. He is dedicated to his work in practice, and his book is, in fact, the story of one man's individual fight for the conservation of wild life in his area in the face of hazards and difficulties of all kinds and from all sides, political, non-political and bureaucratic. He is to be congratulated on the success of his efforts so far; and it is good to know that the Government have honoured him with the Padma Shri—a well-deserved award. It is even better that the area at Dudhwa which himself at the cost of much effort and labour developed and maintained as a sanctuary has been taken over as a national park by the U.P. Government.

The problem of the preservation of what is now left of India's once abundant wild life is one that has progressively grown since 1940. Fifty years ago when the present reviewer entered the I.C.S., it had not arisen, at least not in any acute form. On looking through my own library books on Wildlife, I find that with two exceptions they deal with two aspects only. First there are detailed descriptions of the life and habits of various animals, carnivores and others. Secondly, they are devoted to shooting and to the various types of weapons associated with shikar. Many of these books are classics of their kind, no doubt, as, for example, Dunbar Brander's *Wild Animals in Central India*; and here it is of interest (melancholy now) to note that the second longest chapter in the book is given over entirely to *Tiger Hunting*. Lt. Col. Stockley has entitled one of his books "Big Game Shooting in the Indian Empire" and another simply "Shikar", while Major-General Burrard has written on "Big Game Hunting in the Himalayas and Tibet". The stress was always on shooting, not on conservation. It was probably F.W. Champion ("The Jungle in Sunlight and Shadow" and "With a Camera in Tigerland") who was the first to publicise the fact that shikar with a camera was in every way as exciting and as exacting as shikar with a rifle. Of course, it could reasonably be said for the old timer apart from a few ruling

Princes and landowners who imagined that their prestige depended on the number of tiger skins with which they could "paper" the walls of their banquetting halls or on staircase balustrades made out of sambhar antlers—always obeyed the rules of the game. He did not shoot out of season. He did not sit up for tiger at night with a miniature searchlight—forty five minutes after sundown was the U.P. rule. He left untouched females and young, and he passed over immature deer and antelope heads. It could also be said that wildlife was plentiful throughout the country, the wild life including birds and fish. In the former United Provinces, tiger, panther, sloth bear, were common enough in the hill and terai districts and in the districts bordering on Central India, while deer and antelope of various species were to be seen in fair numbers in almost every district. Fifty years ago in the Lalitpur Sub-Division of the Jhansi District—a sparsely populated, largely forest tract—a six-mile evening walk from the bungalow of the SDO would produce two or three sizeable herds of, black buck, and almost every ravine would hold the prettiest of all gazelles, the chinkara, who would herald one's approach with a startled "sneeze". Farther afield, small panther (as opposed to the large jungle animal locally known as the "dranguwa") would skulk in the rocks close to a village waiting for the return of the village goats in the evening, and hoping to get away with a straggler. Sloth bear, panther, sambhar, cheetal, nilgai were plentiful in and around the forests, and the rivers Betwa and Jamuni held crocodile. Tiger, too wandered in on occasions from the neighbouring State of Gwalior. With the establishment of the Tank School at Babina during the war and the later conversion of that small village into a prosperous cantonment, this happy state of affairs has gone for ever; and so has most of the game.

As Mr. Arjan Singh sorrowfully notes what goes for Lalitpur is true for the whole of U.P. and most certainly for his own Kheri. He has noted that black buck are almost extinct in his area. In 1967 he counted fourteen. Three years later these were reduced to a pathetic remnant of four; and even the four must have disappeared by now, since black buck are creatures of the wide, open spaces and cannot be restricted to a sanctuary. The author has succinctly pointed out that the disappearance of the one-time large herds of black buck in Delhi and Haryana areas is almost entirely due to the telescopic sights of the Diplomatic Corps of New Delhi.

So, too, with the barasingha or swamp deer, which in the author's words "have suffered terrible losses in the last two decades". In 1965 when he and George Schaller carried out a survey in the Ghola area, the expected 1600 animals turned out to be only 600. The jungle animals in the same tract are in the same predicament, and though tiger and panther are popularly supposed to be great predators, the greatest and easily the worst of all the predators is the human animal. Amateur hunters, the professional species, the poachers and trappers, and the farmer with his crop protection licence have all combined. "Tigresses" says Arjan Singh, "have been particularly vulnerable because of their pre-



ference for dropping their April litters in sugar-cane fields. In 1969, for instance, five tigresses were shot, eight cubs captured and three burnt, all in local sugar-cane fields.

Every species of animal life is now on the verge of extinction and some, indeed, have already disappeared, save for a few specimens in zoos, national parks and sanctuaries. The reasons are, of course, well known, and the author has listed them on P 44 and onwards. First there is the rapid growth of the population, and with it the great spread of cultivation which has not only pushed wild life into narrower and narrower confines by destroying its natural habitat but which has also led to the excessively free and easy issue of licences for crop protection. In pre-independence days guns issued for crop protection very often had the barrels sawn off in such a way as to cause a big enough bang to frighten away the nilgai, let us say, without doing any greater harm. Now the position is different, and as the author notes, anyone can cash in on the one man, one vote, one gun licence principle, including anyone who had been in jail during the "Freedom Struggle". In fact, even ordinary criminals came in for the bonanza. On top of all else was added an entirely misconceived commercial and unscientific approach to true value of the forests which has led to the mis-exploitation of the latter. The result has been the systematic felling of magnificent, slow-maturing trees such as the sal (the chief tree of the U.P. forests) which encourages the growth of a smaller range of trees and shrubs, which, in turn, provide shelter for all kinds of wild life. The Forest Department compounded this piece of vandalism and added insult to injury by replacing the areas in point with the rapid growing eucalyptus!

The author had the courage and perseverance by himself to carry on a lone fight against the politicians and local officials for the conservation of wild life in Kheri. He has managed to preserve Ghola—a few miles away from Tiger Haven—as the last refuge of the few barasingha now left in U.P.—largely by taking the law into his own hands and by preventing poaching and illicit cattle grazing. One politician, who deserves to go down to history for the help he gave the author is Ch. Charan Singh, one time Minister for Forests. Ch. Charan Singh gave more than lip-service to the cause of wild life preservation (and in India it is lip-service that gets the votes) by declaring an area of 82 sq. miles round Tiger Haven to be a sanctuary. But we are now in 1975, and Charan Singh is no longer a U.P. minister. Nor is the politician the only one at fault. District and police officers are no longer interested in the wild life of their districts, and regrettable though it may be even the officials of the Forest Department itself for the most part show little interest. They no longer tour as they did in the "bad old days", and such touring as they do is no longer on foot but by car or jeep. At one time in the reviewer's own experience one never saw the DFO (except when one was in his forests) from the commencement of November until the end of May; and the old-timer DFO kept a very wary eye on his Forest Rangers and Forest Guards. Very different is the position today, for as a young and keen Forest Officer—since retired—himself told me "a bottle of rum will enable

anyone to get past a Forest Guard in order to indulge in a little illicit shooting or trapping." The author has a delightful story of a Range Officer, a portly gentleman, who took to his heels in the face of a wounded tiger and who lost his hat on an overhanging branch in the process. Then too, there are the ambitious higher-ups, who like to entertain western diplomats (who ought to know better) to shoot in the hope that this will enhance their prestige in New Delhi. The professional shikari as well as the itinerant cold-weather visitor are another danger to conservation, and the author records that he had first-hand evidence from a party of American hunters who came to visit him and who spoke freely after they had had a couple of tots of "Old Crow" bourbon. They mentioned that they had waited up after dark for a tiger, and had used a light, both of which are offences. On another occasion the author was informed that a tiger cub had been shot. He reported everything to the Forest Department, but as he sadly records "as usual nothing was done." This lack of interest from the side of those who ought to know better has been underscored more than once. "Few of the problems" writes Arjan Singh, "relating to the Sanctuary were strange to me, but I perhaps had not fully anticipated how little help I would get from the authorities whose responsibility it was to look after wild life". In fact, he actually had to do much of the patrolling of the Sanctuary by himself—and this was obviously far too much for one busy man.

What then of the future and the prospects of saving what is left of our wild life? The answer is, of course, anyone's guess, and Arjan Singh pins his hopes on properly constructed and properly cared for Sanctuaries and Parks. But as he himself has made abundantly clear throughout his book there must be a stricter and more efficient administration of the law. As is usual with us in India, we have laws to cover every aspect of life, including the preservation and conservation of wild life; but when it comes to the implementation of the law, we are not so good. We have, for example, a stringent law against the trapping of wild animals, and the subsequent sale of their skins—a very lucrative trade. Yet the trapping continues, as one can see for oneself from the coloured wrapper of *Tiger Haven*, and it is common talk that in the purlieus of Delhi and Calcutta hole in the corner establishments do a very brisk trade in the sale of tiger and panther skins. About a year ago *The Illustrated Weekly of India* had a special article on the trade in Delhi which flourishes under the noses of the officials of the Government of India. Then, too, some months ago there appeared in the *Times of India* (Current Topics) the following which is worth reproduction:—"The arrest of an Indian executive of a foreign international Air Line and the police raids on various premises in this connection have unearthed an apparently major racket in the illegal export of skins of protected animals. But is it almost certain that the 80000 pieces of skins valued at Rs. 60 lakhs and seized at Palam represent only the proverbial tip of the iceberg.....According to the statements recorded by the police this inhuman racket is so lucrative that those engaged in it are able to bribe customs officials to the tune of Rs. 30,000/— for every cargo. It ought to be clear, therefore, that those in the Administration who connive at this nefarious trade need to be dealt with as harshly



as the original organisers of the racket. Otherwise all the eloquence and energy expended on the cause of preserving wild life will prove to be pointless."

Need one say more? Yes, perhaps one thing more. The people of India require to be educated more on the subject of conservation. It is here that our schools and colleges come into the picture. And, indeed, not merely the schools and the colleges for young students, but also the official institutions where men are trained for the civil, the police and military services.

N.B. Bonarjee

I.C.S. (Retd)

**The Book of Indian Animals by S.H. Prater**, third revised edition, xxii + 324 pp., 28 coloured plates (including 141 illustrations) and 40 monochrome plates, 1 map. Bombay Natural History Society, Bombay.

The popularity of Prater's *Indian Animals* has remained unsurpassed by any other semipopular work on Indian mammals ever since the publication of its first edition in 1948 by Bombay Natural History Society. The second edition which was published in 1965 showed tremendous advance over the first particularly regarding numerous coloured illustrations drawn by the highly experienced artist, Mr. Paul Barruel, the chapter on marine mammals written by Dr. E.C. Silas and Mr. J.C. Daniel and other additions carried out with the help of experienced workers. It appears to have been sold out quickly necessitating the publication of the present third edition. In the third edition the reader will find further improvement. Well prepared short notes by Mr. Daniel on important species of bats have been included. Six monochrome plates have been replaced by better ones. The picture on cover has been replaced by more magnificent animal, the Indian Tiger. However, some other important improvements which have been brought to the notice of the publishers by the writer were desirable but have not been carried out because of method of printing, photo offset, as pointed by Mr. Zafar Futehally, Honorary Secretary, in the preface. It is hoped that it may be possible to introduce these improvements in future editions of this otherwise excellent work. All lovers of Indian Wildlife will find the present edition an indispensable one.

H. Khajuria

**Tigerland by Kailash Sankhala (Collins. £ 3.50)** A Great many books have been written in the past about Indian tigers (there is even the autobiography of a tiger!) and recently, too, with the realisation of the precarious plight of this most magnificent of the greater cats and the concerted attempt to save it in India, quite a few books and booklets have been published on the tiger.

Mr. K.S. Sankhala, who won a Jawaharlal Nehru fellowship for his work on tigers in India, has attempted the first, mainly pictorial, account of the tiger, the forests it inhabits, and its prey and associate animals—an extremely difficult task, as those familiar with wildlife photography in our forests will know—and none but the most carping of critics will deny that he has succeeded brilliantly in the attempt.

Being pictorial and popular, this book will help in creating a less apathetic and even less hostile feeling towards tigers and other wild animals in India. There is a foreword by Mrs. Indira Gandhi, whose interest in our wildlife is well known, and in his brief introductory text the author provides a wholly admirable summary of the factors that have caused the lamentable decline in our wildlife, and stresses the need for total environmental protection if the tiger and other wild animals are to be saved.

Particular mention should be made of the following outstanding photographs: the two colour pictures on the jacket, the one on the front cover being a close-up of a recumbent tigress (presumably from a zoo—the same animal figures in monochrome plate No. 27, also a fine picture), and the tigress on the back cover being from Kanha.

Among the monochrome plates I consider exceptionally good are: No. 10 showing a pregnant tigress sleeping on her back in sal cover, from Kanha; No. 11 showing a tigress (presumably a zoo animal) carrying her cub; No. 31, a head-study of a langur, and No. 33, showing a party of langur; No. 38 showing a courting tusker in Corbett Park; No. 39, featuring two rim-lit peahens; No. 47, a chital stag with jungle mynas (wrongly captioned 'common mynas') perched atop him; No. 52, a fine picture of a bull nilgai and langur feeding at the same big tree; No. 55 of a ruddy mongoose (not because it is clear, but because it is the only picture of a wild ruddy mongoose I have seen); No. 57, a superb study of a husky jungle cat; No. 60, a monitor lizard; Nos. 74 and 76, both of sambar hinds at Ranthambhor; Nos. 83 and 84, of the same pregnant tigress at Kanha; Nos. 93 and 94, showing a tiger and a chowsingha going flat out—these two plates have been cleverly juxtaposed so that the tiger seems to be chasing the antelope.

It is difficult to understand why these singularly poor photographs have been included in the book: Nos. 8, 9, 17 and 117, all tigers; No. 59 showing a crocodile and a softshelled tortoise; No. 63, a herd of chital in Kanha; and No. 64, a blurred picture of flamingos in the Rann of Cutch (which is surely not in any tigerland, even if the author brings in Gir by sleight of logic!).

The claim (in the note on the author on the jacket) that Mr. Sankhala "is the only naturalist to have travelled throughout India's tigerland" will bring a smile to many lips—but no doubt it is true that not many have had his opportunities.

It is realised that in a book whose main contents are the pictures, with their captions providing the only information available about them, the skill with words needed for the



captions may be beyond most naturalists. However, quite a few captions in the book need correction in their natural history.

It is not true that gaur cows rarely bring their calves out into the open, as is suggested in the caption to plate No. 41. The slender loris, far from being a creature of the ever-green forests of the Western Ghats (No. 56), is much commoner in mixed and even dry deciduous forests in eastern and central south India. In plate 83, an obviously male tiger is specified and in 84 a pregnant tigress—both pictures are of the same pregnant tigress in the same setting. The bird in plate 105 is a Lesser White Scavenger Vulture and not a King Vulture.

While it is true that photographing wild elephants can be risky, the tusker in plate 36 need hardly have caused any trepidation to the photographer, having so much water to cross before he could get at his man—the tusker looks strangely like Kali Prasad, the lanky, a 9 feet 9 inch high riding elephant at Manas that I have measured, ridden and photographed, with the long, thin tusks untrimmed and the right lower than the left.

There are quite a few printing errors. The generic name in scientific nomenclature always starts with a capital letter, not with a lower-case letter as consistently spelt in the book: there are other errors, too.

M. KRISHNAN

The claim in the note on the jacket that Mr. Shankar is the only naturalist to have travelled throughout India's tigerland will surely be a little misleading, but no doubt it is true that not many have had his opportunities. It is regretted that in a book whose main contents are the pictures with their captions providing the only information available about these animals, the skill with words needed for the

## Observations on the coitus of *Orthetrum pruinolum neglectum* (Rambur) (Insecta: Odonata)

*Orthetrum pruinolum neglectum* is one of the most common species and distributed throughout India (Fraser, 1936). It is a fast running insect and can be collected throughout the year without much difficulty.

During September-October 1974 their swarms were observed at Sahastradhara (a hill stream Ca. 13 Km. NE. of Dehra Dun, U.P.). While some of them sitting quite on twigs projecting over water or on the rock, for few minutes at a time, now and then taking off to circle the water and return to the exact same spot, to sit at the exact same angle before repeating the performance.

The act of coitus which occurred on the wing was observed twice. In the first case on October 12, 1974 a female flying within a few feet over the water was accompanied by a male flying just above her. Within a few minutes, no sooner another male came close to the first, both males dashed off with utmost agility leaving the female in the area. After about two minutes the male came again and clasped her head with its anal appendages followed by turning of her abdomen within few seconds. They were in coitus for one hour and twenty minutes and during this time they rested on the twig and a stone, while taking off to circle off and on. Again on October 19, 1974 the coitus was observed without any disturbance, which lasted for one hour and thirty five minutes. After coitus the female were seen dipping their abdomen in water while in the tendum.

The specimens bear the following identical data in addition to the Registration Nos. A-2842 and A-2843: India, Sahastradhara, Distt. Dehra Dun, 19th October 1974, Coll. R.N. Bhargava; *Orthetrum pruinolum neglectum* (Rambur), ♂, ♀; Det. M. Prasad, 1974, Zoological Survey of India, Northern Regional Station, F.C. No. 1.

*Orthetrum pruinolum neglectum* male can be easily recognised in the field by their bright violet red abdomen and pruinose reddish brown thorax with the other included species of the genus.

We are thankful to Dr. B.S. Lamba, Officer-in-Charge, and Dr. Asket Singh, Superintending Zoologist, Zoological Survey of India, Northern Regional Station, Dehra Dun, for facilities and encouragement.

Northern Regional Station,  
Zoological Survey of India,  
Dehra Dun.

Mahabir Prasad  
and  
R.N. Bhargava

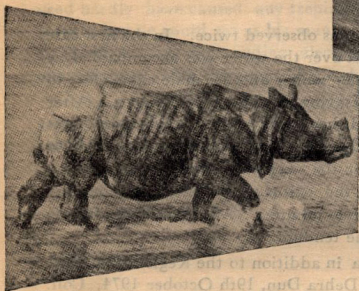
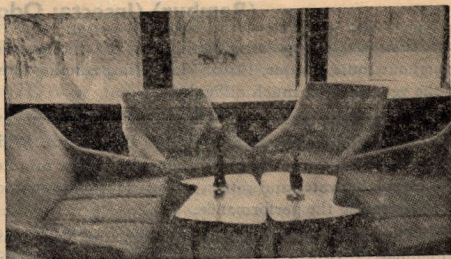
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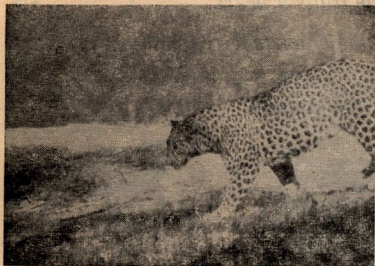
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- (b) To co-operate with the Govts. of India and States and with other Societies and Institutions having similar aims and objects in working for the interests of wild life.
- (c) To assist in enforcing and actively supporting the Forest Acts, Wild Birds and Animals Protection Acts and Rules etc. of States and the Indian Arms Act and Rules in so far as they pertain to wild life and to bring to the notice of the authorities any infringement of the same and to assist in the detection and prosecution of offenders in respect of such laws.
- (d) To advise and help the Govt. and wild life administrators in the formation, maintenance and protection of Sanctuaries and National parks, the preservation of wild life in general and rare species of India in particular and in the introduction of exotic species into the country, the rehabilitation of rare species etc. and in the revision on rational lines of the shooting and fishing rules, so as to conserve and increase wild life stocks.
- (e) To raise funds for the carrying out of the above aims and objects and to found and maintain museums, reading rooms and libraries of natural history in order to disseminate knowledge regarding wild life.
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- (g) To carry out publicity and propaganda for the preservation of wild life in India by means of monographs, journals, films, film strips and other feasible methods.
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